University of Alberta

Research Utilization in Nursing: An Examination of Formal Structure and Influencing Factors

by

Carole Anne Estabrooks

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree Doctor of Philosophy

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled *Research Utilization in Nursing: An Examination of Formal Structure and Influencing Factors* submitted by Carole Anne Estabrooks in partial fulfilment of the requirements of the degree of Doctor of Philosophy.

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In loving memory of....

Margaret G. McPhedran
Teacher

Gladys A. Drake
"Aunt Gladys"

&

Francis W. Estabrooks
Dad

....each of whom shaped a part of my life, and each of whom would have, in their way and for their reasons, been proud.

Abstract

The purpose of this study was to understand factors influencing the utilization of research by nurses, and how those factors work together. Specifically, causal relationships were examined between individual and professional variables and the outcome variable, research use. Data were collected from a large random sample of practising Alberta nurses using a *Research Utilization Survey* developed and piloted by the investigator. Using the data from this survey, a series of structural equation models (SEM) were assessed using LISREL. The modeling exercises were successful in locating a model of research utilization (a "core model") that illustrates the causal influence of direct (instrumental), indirect (conceptual), and persuasive (symbolic) research utilization on overall research utilization. Previous empirical studies reporting such a structure of research utilization were not located. This is a significant contribution to our understanding of the core elements in research utilization theory. A better understanding of what research utilization is will contribute to a stronger base from which to discuss causal models that include characteristics of the practitioner, the setting and the research or innovation itself. The findings related to the core model also contribute to our understanding of measuring research utilization in nursing. In this study characteristics of the practitioner were also examined, but less success was realized in trying to model these factors. All but three of twenty-five individual and professional concepts entered

into the structural equations failed to reach statistical significance. This brings into question current conceptualizations of the individual forces that combine to influence research utilization. If research utilization is indeed sensitive to organizational and other contextual influences, as they are experienced by the individual, then an understanding of these individual influences is important to our ability to model these more complex causal structures.

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The first acknowledgement must go the hundreds of practising nurses in Alberta who took time from their busy lives to complete the lengthy survey used in this study and in so doing contributed to our understanding of research utilization in nursing.

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Third, I would like to acknowledge the generous financial support of the National Health Research Development Programme (NHRDP), the Canadian Nurses Foundation (CNF), the University of Alberta, the Alberta Association of Registered Nurses' research grants-in-aide programme, and the University of Alberta, Faculty of Nursing's internal allocation research grant fund.

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Chapter 1

Introduction

Some eighteen months ago I wrote the following introduction to the proposal that formed the basis for this dissertation:

> The research study outlined in this proposal was motivated by the investigator's 18 years of experience in nursing, most of it in the acute care practice setting. During that time, through many versions of quality initiatives--quality assurance, quality circles, quality control, quality improvement, total quality management, integrative quality management--and through many different professional responsibilities from the intensive care bedside to senior management, I have believed that if we knew the best nursing interventions and if we employed those interventions, then patients would get better faster, with fewer complications; their families would fare better--and the patients who died would do so with greater comfort and greater dignity. Furthermore, as a professional engaged in or facilitating that kind of practice, I would reap the rewards of knowing I had done the best I could--and I would sleep better at night when the ghosts that rob you of peace of mind come--the ghosts of inadequate skill, inadequate knowledge, inadequate experience. I have believed through most of those 18 years that if nursing is practised with the *best evidence* available that it is better nursing for each individual concerned, and ultimately for society. While I grow more aware of the inexactitude of the science and art that comprise nursing, and of our limitations in perfecting it, I remain convinced that there is a pressing need to find more effective ways than we have thus far to deliver nursing services from an evidential base. The proposed study is a scientific way of approaching an area that some would argue is more art than science. While the solutions nurses seek to the problem about to be identified lie in the appropriate use of both scientific and practical (art) knowledge by nurses, this study addresses only the scientific dimension.

Now, having completed the study I return to those words to see if I have answered my longstanding questions; and to find inspiration for the final words of this dissertation that will introduce you, the reader, to its contents. The answers I find, remain largely undiscovered, but the questions have become more focused and the direction of the search more clear. Conventional nursing wisdom has not withstood my statistical manoeuvring in all cases and sometimes my manoeuvres have not withstood the

unforgiving implications of the data. However, the journey has been informative and has left me more firmly ensconced in my belief that, as nurses, we should strive to practice with the *best evidence* available. That evidence will sometimes be research evidence and where it is our efforts must be directed at maximizing its use. That evidence will often be of a different nature; it is for others to accept the challenge of comprehending and legitimating that evidence.

Overview of the problem

The *problem* has most often been stated as that of a gap between what we know and what we do. In 1966 Glaser and Marks wrote:

> All over the world people struggle with problems and seek solutions. Often those who struggle are unaware that others face similar problems, and in some instances, are solving them. It is destructive and wasteful that people should be frustrated and often defeated by difficulties for which somebody else has found a remedy. . . . The gap between what we know and what we put to effective use bedevils many fields of human activity--science, teaching, business management, and organizations that provide health and welfare services. (p. 6).

This gap between what we know (research) and what we use (practice) is the crux of the research utilization problem in nursing, or as it might be called, the theory practice problem: how do we get knowledge, for the most part a particular kind of knowledge, into the hands of, and used by, the clinician in a timely manner? That timeliness is an issue, is illustrated by Glaser, Abelson and Garrison (1983, p. 8-11) when they report the average time from conception to realization of innovations as 19.2 years. The nursing literature is replete with calls to make the practice of nursing research based. Early calls for bridging the gap between research and practice included Abdellah (1970), Henderson (1964), and King (1968). Later day calls include equally able and influential leaders (Barnard, 1986a, 1986b; Cronenwett, 1987; Duffy, 1985; Fawcett, 1982, 1984; Gennaro & Vessey, 1991; Hinshaw, 1987, 1988; Lindeman, 1984; Werley, 1979). The study reported here was designed to explore that gap by assessing the integrity of a series of structural equation models depicting causal relationships between variables measuring research utilization, and between individual and professional variables and research utilization.

Significance

The importance of research utilization as a field of study lies at the very foundation of why members of a practice discipline conduct research. Nursing is not an academic discipline, but rather a professional or practice discipline (Donaldson & Crowley, 1978). Consequently, we do not do research for the sake of doing research or for the sake of adding to a corpus of knowledge. Rather, we do research that ultimately

must have some practical use to clinicians.[1] But to do that research is only part of the task, it has to be put to use by clinicians for the benefit of patients/clients to complete the equation. The central benefit and the one on which all others are dependent is that the health of people stands to be improved--whether that improvement occurs within the context of treatment, the context of prevention, or within a health promotion context. Because of the singular focus on the utilization of *nursing* research to date, it appears as if the research utilization agenda in nursing may have been fuelled primarily by the drive for professional status. Legitimatization of the place of nursing in the university, among the professions, and in society is, in part at least, dependent not only on generating nursing knowledge through research, but also by demonstrating that such knowledge is of use to clinicians, and ultimately to the members of society. A motivation more clearly oriented to patient/client health improvement, should result in research utilization studies and conceptual discussions that examine other kinds of research than nursing, and other sources of knowledge than research. This study attempted to accommodate both perspectives by focusing on the utilization of research, regardless of the discipline of origin and by addressing questions that were more discipline specific. Other sources of knowledge, and the extent of utilization of research from nursing and non-nursing sources were also sought.

Recent beginning evidence from meta-analyses has begun to confirm that research based nursing interventions have the potential to positively affect client/patient outcomes. These are discussed in chapter two. While the results of these studies need to be carefully and critically considered, they are promising. They represent powerful arguments the profession can employ to advance its case for the conduct and utilization of research in nursing. However, the individual studies making up the pools of studies in these meta-analyses are often conducted under experimental or quasi-experimental conditions. Moving from the results of these analyses to the practice setting to claim that research when used by clinicians results in improved client/patient outcomes may not be warranted in many cases until we have aggregated individual meta-analyses into pools of "evidence" such as are found in the Cochrane database of Systematic Reviews (CDSR) and the United States based Agency for Health Care Policy and Research (AHCPR) clinical practice guidelines.[2] Even then nursing, as well as the other health professions, are still left short of actual *use* and faced with the realization that we have yet to study

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[1]This does not discount the historical and philosophical research that is conducted by some members of nursing. Our continued professionalization is in part dependent on ongoing and vigorous historical inquiry. Certainly our practice draws from the understanding we develop as various of the philosophical domains such as ethics are explored. Our science which informs our practice is also dependent on the ongoing development of domains such as philosophy of nursing science.

[2]Both of these rapidly expanding databases are now available via the Internet and can be located by using any of the standard search engines (e.g., Netscape). The Cochrane database in particular, is global in nature with a Canadian Centre at McMaster University in Hamilton, Ont. The collective effort of the Cochrane participants is often referred to as the "Cochrane Collaboration."

most aspects of the dissemination, adoption, transfer, implementation and utilization of research process. The challenges inherent in these areas are at least as daunting as those of establishing a pool of traditional research evidence for they involve the ability to influence human behaviour in the practice context.

Purpose and Objectives

The purpose of this study was to expand existing knowledge of research utilization in nursing by expanding our understanding of the causal mechanisms underlying the utilization and the non-utilization of research by nurses. More specifically, the purpose of this study was to examine the causal relationships between identified individual (personal and professional) variables of practising nurses and the utilization and non-utilization of research by those same practising nurses in Alberta. With data obtained by survey questionnaire, a series of structural equation models were assessed using LISREL. The primary objective of the study was to determine and test the causal structure of a model in which individual variables influence the instrumental, conceptual and symbolic (political) utilization of nursing research.

Research Question(s)

The primary research question in this study was: *What individual (personal and professional) factors influence the utilization or non-utilization of nursing research by practising nurses?* Additional questions included:

2. What is the underlying causal structure of research utilization and its sub-types?
3. Do nurses employ some kinds of research utilization more frequently than others?
4. Can factors influencing non-utilization, as well as, utilization be identified?
5. What other sources of knowledge (research and non-research) do nurses use in their practice?
6. Do selected organizational and innovation variables change the causal structure of the proposed model?

Data were collected to enable responses to each of these questions either now or in future analyses. The study reported here addresses the first (primary) and second research questions. In the following chapter the literature review which informed the development of the study framework and study methods is presented. The remainder of the dissertation follows in traditional form.

Chapter 2

Literature Review

The purposes of this literature review are to first, present an overview of the literature used in the development of the study; second, identify critical issues in that literature; third, briefly present the current state of knowledge in nursing specific to research utilization; and fourth, argue that sufficient support exists in the literature to justify the development and assessment of the series of models presented in subsequent chapters. The literature reviewed included all nursing literature indexed in CINAHL from 1982 to August 1996 and MEDLINE from 1976 to August 1996, as well as any nursing literature cited in any article from this search that was deemed relevant to research utilization. Additionally, known and available materials from the major research utilization initiatives in nursing were retrieved, as were unpublished materials, e.g., dissertations, when they were deemed to be relevant to this study's purpose. All major and critical work in nursing was reviewed. At this time in nursing it is still possible to review the entire domain of published work in this field; however, this is rapidly changing.

Selected literature outside of nursing and other health sciences was reviewed by using a series of approaches. First, an independent study was conducted.[1] A main purpose of this study was to become familiar with critical literature in the general area of innovation diffusion as it represents the largest collection of literature outside of nursing.

Second, four key publications were reviewed (Glaser, Abelson, & Harrison, 1983; Havelock, 1969; Rogers, 1983, 1995; Zaltman, Duncan, & Holbeck, 1973). These works represent substantial contributions to our understanding of the origins of the work that has been and is being conducted in the area of research and knowledge utilization, knowledge and innovation diffusion, technology transfer and evidence based practice. I considered that these works provided an acceptable review of the historical evolution of the field up to at least 1983; additionally they facilitated the location of additional sources.

Third, all of the reference lists of the nursing articles and books were reviewed for

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[1]This was done under the direction of Dr. Richard A. Wolfe (whose own dissertation work was in the area of innovation diffusion) in the Faculty of Business at the University of Alberta.

reference to material outside of nursing, not covered by the procedures described thus far. This resulted in the uncovering of a body of literature from the social sciences published mainly in the journal *Knowledge: Creation, Diffusion and Utilization* (published since September 1994 as *Science Communication*). This material was retrieved (and its reference lists scanned) and as well, several years (1980-1988 and 1994-1995) of this journal were scanned manually as they were readily available to me.

Fourth, the online databases ABI-INFORM (business), ERIC (educational), HEALTH (health services), PSYCHINFO (psychology), SOCIOFILE (social sciences), and CURRENT CONTENTS (social sciences) were searched using the key words research utilization, innovation diffusion, technology transfer, evidence based practice, and clinical practice guidelines. Each was searched for the period that it covered, in most instances this represented the last 15 to 20 years. Material from each that was relevant to this study was examined. A final updating search of online bibliographic databases was conducted in September 1996 by a health sciences librarian in consultation with myself. This search was restricted to empirical studies published in 1996 that specifically addressed factors (variables, characteristics) influencing the use of research or the adoption of innovations by individuals. This was conducted using the aforementioned databases and with the addition of the SSCI database. It was done to ensure that critical and recent studies had not been missed and to capture entries not yet available through onsite library access points.

The literature review is presented using the following outline: (1) historical perspective, (2) assumptions and models, (3) the current context in nursing, (4) factors influencing research utilization, and (5) summary. Not addressed in this literature review is the adoption curve, the stages of innovation, strategies for influencing research utilization, mathematical models of diffusion, or the role of research in formulating policy.

Historical Perspective

The origins of the field

The task of sifting through the genesis of research utilization generally, and in nursing, is immense. The entire field of study has been described as a "terminological tangle" by Larsen (1980). Definitions are frequently missing or absent from articles, different disciplines use different terminology, most of the literature rests on assumptions that are rarely made explicit, and investigators, at least in nursing, appear to have assumed that terminology and concepts from other disciplines are readily transferrable to nursing. While two good conceptual papers have appeared in the nursing literature (Loomis, 1985; Stetler, 1985), as a discipline we have paid little attention to clarifying the conceptual basis of research utilization. Most often, it is equated with classical diffusion theory (Rogers, 1995). This is not to say that investigators have not been careful to make

explicit the theoretical perspective underpinning their work. Generally they have; the CURN project is a good case in point (Horsley, Crane, Crabtree, & Wood, 1983). However, they have not attended to the almost universal slippage in the equating of research utilization with innovation diffusion. Additionally, the sheer volume of material available is daunting. Rogers (1983) identified 3085 publications available on diffusion research alone in 1981, and adjusted that number to over 4000 in 1995 (Valente & Rogers, 1995). Backer (1991) indicated that there were some 10,000 literature citations in knowledge utilization early in this decade. There are literally tens of thousand citations available in the areas of innovation diffusion, knowledge utilization and technology transfer. In nursing and related health fields alone, Rodgers (1994), searching mainly MEDLINE, located 2682 journal articles from the last ten years. Wolfe (1994a), located 1299 journal articles and 351 dissertations addressing organizational innovation in a five year period. Given the enormity of the area, an attempt at placing the study in context is useful in establishing some perspective on both its potential for contribution and its limitations.

The history of research utilization as an area of study in nursing is usually dated from Ketefian's (1975) often cited study in *Nursing Research*.[2] It is not surprising that the field did not develop earlier given that the professionalization of modern nursing did not begin until the late 19th century and research was not a legitimate activity for most nurses until well into the 20th century; for example, *Nursing Research* the first peer reviewed research journal in nursing did not appear until 1952. No comprehensive account of the development of research utilization as an area of interest or a field of study in nursing exists. However, if one examines the early research utilization projects carefully it is clear that a few individuals have had a significant impact on our development to date--Everett Rogers, Ronald Havelock, Edward Glaser, and to a lesser extent Donald Pelz.[3] Interestingly, Rogers, Glaser and Havelock have authored the major integrative reviews of knowledge utilization and innovation diffusion research in existence (Glaser, Abelson, & Garrison, 1983; Havelock, 1969; Rogers, 1995). Rogers, in particular has had an impact on nursing scholars who have drawn extensively on his work. Stetler (1985, 1994a, 1994b) is one of the few nurses scholars who has not cited Rogers work as extensively, but rather has turned to others in the field more closely aligned with knowledge and research utilization (Dunn, 1983; Larsen, 1980; Weiss, 1980), as opposed to, innovation diffusion. Given the significant influence of other disciplines on nursing research in this area it is instructive to turn briefly to the origins of that work.

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[2]In actuality, Helen Shore an assistant professor at the University of British Columbia published the first account I could locate of a study dealing with some aspect of innovation diffusion: Shore, H. (1972). Adopters and Laggards. *Canadian Nurse*, *68*(7), 36-69.

[3]Pelz and Horsley worked together when they were both in Michigan, see Pelz and Horsley (1981).

The history of the development of innovation diffusion as a research tradition is well documented (Crane, 1972; Rogers, 1995; Valente & Rogers, 1995). Rogers (1995) in particular provides a thorough analysis of its origins. These authors have used a Kuhnian framework for their analysis of the rise and fall of the diffusion paradigm among rural sociologists. Most authors trace the origin of diffusion research to the landmark 1943 study by Ryan and Gross on the diffusion of hybrid corn seed in Iowa. Rogers (1995) traces it to the 1903 work of French sociologist/social psychologist Gabriel Tarde. Rogers identified nine diffusion research traditions: anthropology, early sociology, rural sociology (the predominant one until the 1960's), education, public health/medical sociology, communication, marketing, geography, general sociology, and "other" (1995, chap. 2). Two studies from these nine traditions are frequently cited--the Ryan and Gross hybrid corn study, and the 1955 Menzel and Katz study in which the diffusion of a new antibiotic was studied among New England physicians. Roger's work (Rogers & Agarwala-Rogers, 1976; Rogers, 1962, 1983, 1986, 1988, 1995; Rogers & Shoemaker, 1971) has made an enormous impact on the field of diffusion research, in fact, the 1962 work is credited with being the key factor responsible for the spread of the diffusion paradigm to other disciplines such as public health, economics, marketing and political science (Valente & Rogers, 1995). Interestingly however, Rogers makes only passing reference to the concepts of research and knowledge utilization. Nursing has been a heavy importer of Roger's concepts and theoretical positions, although some nurse scholars (Loomis, 1985; Stetler, 1985, 1994a, 1994b) have imported more extensively from the less well defined field of knowledge utilization.

The history of the field of knowledge utilization is more difficult to trace. The most often cited source from the knowledge utilization field is Glaser, Abelson and Garrison's (1983) encyclopaedic review of the literature on the topic. In nursing, the work of Dunn (1983), Larsen (1980), Sunneson and Nilsson (1988) and Weiss (1979, 1980) are frequently drawn upon. Recently, Backer (1991) organized the evolution of knowledge utilization in three "waves", the first being the period 1920-1960, the second 1960-1980, and the third 1990 to the present. He attributes the Regan administration in the United States with a decade of drastic reduction in priority and resources to this field during the 1980s. Backer (1991) marks the second wave with the emergence of three journals--the *Journal of Technology Transfer* in 1975, *Knowledge: Creation, Diffusion, Utilization* in 1979, and *Knowledge in Society* in 1988 and the emergence of two professional societies--The Technology Transfer Society founded in 1975 and the Knowledge Utilization Society founded in 1985. It was during this second wave that the major research utilization initiatives in nursing were established. Predictably during the Regan administration there was little progress on the research utilization agenda in nursing.[4] Backer's (1991) work does not clarify the relationship between innovation diffusion and

[4]The activity in the United States is a good indicator of research utilization progress in nursing because until recently almost the only nursing work in this area originated with American scholars.

knowledge utilization, and his retrospective naming of the innovation diffusion work prior to the 1970's when the term appeared in the literature may have to suffice.

Beal, Havelock and Rogers (in Beal, Dissanayake, & Konoshima, 1986)[5] offered additional insights into the origins of the field of knowledge utilization, which Havelock terms "knowledge generation, exchange and utilization" (KGEU). Beal (1986) attributes the growth of the field to the vigorous promotion of knowledge and technology as desirable post World War II, particularly in the United States. In this framework, science is accorded high social status and significant resources are diverted into the scientific enterprise. Havelock considers KGEU's parent discipline to be sociology (sociology of knowledge, sociology of science, and rural sociology, especially diffusion of innovation research), but also acknowledges social and organizational psychology as important contributors. Rogers, in discussing knowledge transfer in this same volume, acknowledges that the term knowledge transfer is often used synonymously with knowledge utilization, technology transfer and the diffusion of innovations "although these concepts are not exact synonyms" (p. 39). In his discussion Rogers clarifies the importance of discussing and understanding the agricultural extension model because it has been so influential to the thinking of scholars in the field. The importance of Ryan and Gross' classical agricultural study is difficult to overstate; it laid, as Rogers indicates, the template for classical diffusion theory over the next 30 to 40 years. In nursing we have been heavily influenced by classical diffusion theory. A striking feature when trying to sort the fields of study is that, while each has its own distinct scholars, the central figures in one overlap with the central figures in the other. The players are not the conceptually confusing features of the area, rather the persistent intermingling and synonymous use of terms that do not mean the same thing cause the confusion--it is in its simplest form a definitional problem.

Innovation diffusion as a field of study is a precursor to knowledge utilization, not a separate entity. The increasing realization that diffusion is essentially a communicative and interactive social process (Rogers, 1995), the expansion of the diffusion tradition into disciplines beyond rural sociology, a growing interest in communication as an area of study, and a growing belief in such strategies as social marketing as effective for bringing about mass change in behaviour have resulted in the expansion of the innovation diffusion field to include more general theorizing. That more general theorizing now encompasses the field known as knowledge utilization.

The distinction between innovation diffusion and knowledge utilization is useful because of the significant influence of the agricultural extension model. Loomis (1985) and Shaperman and Backer (1995) conceptualize knowledge utilization as the over arching domain. In her important discussion in nursing on knowledge utilization,

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[5]Dunn, Larsen and Weiss are also contributors to Beal et al.'s 1986 volume.

Loomis considers research utilization a special form of knowledge utilization, and does not discuss innovation diffusion. She may be the only nurse author in this area who does not reference Rogers at any point in her discussion, leaving the impression that knowledge utilization and innovation diffusion are two separate fields. Additionally, while Stetler's (1985, 1994b) work is equally important to nursing, and while she draws primarily on knowledge utilization sources, she does include mention of Rogers work but does not clarify its relationship to research utilization. Most often, in nursing, the clarification is to use the phrase "the product of the research is an innovation" and with that move from a knowledge/research utilization mode to an innovation diffusion one. Further, in nursing, a concern is that we have not understood the foundations on which classical diffusion theory and knowledge utilization have been developed. This has led to the uncritical adoption of concepts and perspectives from those areas. While nursing--as is the case with all other disciplines--has and will continue to draw on this work, it is incumbent upon us to identify those points where we cannot introduce the frameworks from other traditions unchanged into our own.

One final note toward trying to clarify the juxtaposition of knowledge utilization, research utilization and innovation diffusion. In my examination of the literature in this field, I have noted that the knowledge utilization literature is predominately concerned with the relationship of knowledge, usually in the form of research, to policy (Lindquist, 1988; Lomas, 1993; Nilsson & Sunesson, 1993; Sunesson & Nilsson, 1988; Sunesson, Nilsson, Ericson, & Johansson, 1989; Valente, 1993). The innovation diffusion literature is less oriented to policy although clearly there are important policy implications.

Significance of the field: Interventions and outcomes

As recently as 1978, the most significant problem in research utilization studies was the lack of available studies *to utilize* (Kreuger, Nelson, & Wolanin, 1978). More recently, Brett's (1987) need to return to the CURN project's protocols published in 1981 to augment her own extensive literature review and search for "useable", i.e., scientifically sound, nursing interventions suggests that we have much yet to do in the area of generation of clinical research. However, the body of research in nursing is increasing (Moody, Wilson, Smyth, Schwartz, Tittle, & Van Cott, 1988); as it does, we slowly gather evidence to support long standing beliefs that the utilization of research results in improved client/patient outcomes. It is this improvement in health outcomes that has the potential to significantly drive the research utilization agenda in nursing, resulting in its placement on the national funding priority agenda. If evidence were to continue to mount about the efficacy and effectiveness of nursing interventions arising from nursing studies, the profession would in all likelihood realize two other related benefits. First, funding for both nursing research and nurse scientist training would be increasingly available, and second, the professionalization agenda of the profession would be advanced. While these are not insignificant benefits, the central benefit and the one on which all the others are dependent is that the health of people stands to be

improved--whether that improvement occurs within the context of treatment, the context of prevention, or within a health promotion context.

Recent beginning evidence that research based nursing interventions have the potential to positively affect client/patient outcomes include the meta-analyses of Beck (1995); Blegen (1993); Broome, Lilis and Smith (1989); Brown (1992); Brown and Grimes (1995); Devine (1992); Devine and Cook (1983, 1986); Devine and Reifschneider (1995); Goode, Titler, Rakel, Ones, Kleiber, Small and Triolo (1991); Hathaway (1986); Heater, Becker and Olson (1988); Irvine and Evans (1995); Kinney, Burfitt, Stullenbarger, Rees, & DeBolt (1996); Krywanio (1996); Mullen, Mains and Velez, 1992; Mumford, Schlesinger and Glass (1982); Olson, Heater and Becker (1990); Schwartz, Moody, Yarandi and Anderson (1987), and Theis and Johnson (1995). While promising, the results of these studies must be considered carefully. They represent powerful arguments the profession often employs to advance its case for the conduct and utilization of research in nursing. However, these meta-analyses result in conclusions about the efficacy of interventions usually *under experimental or quasi-experimental* conditions. To move from the results of these analyses to the practice setting and claim that research when used by clinicians results in improved client/patient outcomes may be unwarranted. We have not studied most aspects of the dissemination, adoption, transfer, implementation and utilization of research process in nursing. We do not know if *reinvention* (Larsen, 1980; Lewis & Siebold, 1993; Rice & Rogers, 1980; Rogers, 1995, 1988), for example, is a factor when research is moved from the study to the practice context. If it is, then the efficacy of an intervention under study conditions cannot be simply extrapolated to the practice setting.

Lomas (1993) reviewed the evolution of structures for research transfer, focusing mainly on clinical (medical) practice, and concluded that there have been two distinct phases and that we are in the beginning stages of a third. Those stages are passive diffusion (publish it and it will be used), active dissemination (synthesize the research, creating clinical practice guidelines and they will be used), and coordinated implementation (actively market the packaged research and it is more likely to be used). In this view of research transfer structures meta-analysis is the method of choice in phase two. However, the ability of meta-analyses to demonstrate the efficacy and potential effectiveness of interventions remains an intermediary step. Their application and testing in field settings remains to be accomplished before we can less equivocally assert causal links between research and improved outcome. Nonetheless, the potential to improve outcomes with research based interventions, or as the medical community describes it--evidence based practice (Elmslie, 1994; Guyatt, 1991; Sox & Woolf, 1993), is clearly present. There is ample evidence as demonstrated in the many publications on research utilization both within, and outside of nursing, of a strong and persistent belief in the scientific and professional community in the utility of getting the knowledge into practice. While some of this may reflect a pro-innovation bias (Kimberley, 1981; Rogers, 1995; Romano, 1990; Van De Ven, 1986), much of it undoubtedly reflects a commitment

to the importance of getting knowledge into practice, developed over the last 90 years of work and study in the area.

Assumptions and Models

Assumptions

At least six major assumptions are operant in the literature, that is, six positions or in some cases biases are implicit in the conceptual and empirical work on research utilization and innovation diffusion. These assumptions, as they are called here, have been influential in nursing as well as other fields. An understanding of them informed the formulation of this study. The first of these, a *pro-innovation* bias dominates the literature both within and external to nursing. The pro-innovation bias position assumes that innovation is positive. It is addressed by Abrahamson (1991, 1993), Kimberley (1981), Rogers (1983, 1986), Romano (1990), Van De Ven (1986), Zaltman (1979) and others. One problem with such a bias is that it tends to preclude us from considering non-utilization as a viable alternative. Kimberley, over a decade ago, predicted that we would enter a phase of increased skepticism regarding innovation research. This stage is not present in the nursing literature and is not readily apparent in the non-nursing literature. A more skeptical view of innovation might be advantageous and a great deal learned by studying the processes inherent in the failure to adopt particular practices i.e., non-utilization.

The second assumption is made explicit by Rogers (1983, p. 106-107) and is implicit within the nursing literature. It is that *good workers (nurses) use research*; it resembles a "blaming the victim" stance, in which nurses who do not use research are considered less than professional. This is problematic on two counts. First, we are really unable to say at this point in nursing's development that nurses do not use research because we have only tried to measure a narrow conception of research utilization and have only done so a handful of times in 20 years. Second, this assumption discounts the multiple system factors that operate on micro and macro levels and which form the context within which nurses practice. The individual blame perspective probably came about because of the focus on individual innovativeness (Rogers, 1995) early in the development of innovation diffusion. Anyone trying to determine the extent of research utilization in juxtaposition with individual factors or trying to determine factors influencing research utilization faces the challenge of refraining from this perspective.

A third assumption and one that follows logically from a pro-innovation bias is that research utilization results in an improved situation, or in the case of nursing, in improved nursing practice. In nursing, the standard approach taken is to take a group of research studies that have been evaluated against a set of criteria for scientific merit, and judging them as sound, try and implement them in the practice setting, perhaps in the

form of a clinical protocol.[6] We assume that this will lead to improved outcomes. Separate from the difficulty inherent in identifying and measuring outcomes, this may be an unwarranted assumption. While on a common sense level this is logical reasoning, it is probably too simplistic to be *necessarily* true in the complex practice setting. However, we should not be blinded to the possibility that improved outcomes demonstrated under experimental conditions, may not necessarily hold when the intervention is implemented on a large scale in non-experimental conditions. We have little in the way of demonstration projects that offer indications of the effects of larger scale research utilization in the practice context. Concepts such as transformation (Orlandi, 1986), reinvention (Larsen, 1980; Lewis & Siebold, 1993; Rice & Rogers, 1980; Rogers, 1995, 1988), and synergistic interaction and diffusion in which the adoption of one innovation facilitates or dampens the adoption of subsequent ones (Fennell, 1984; Kimberley, 1981) may occur between the context of the research study and the context of the practice setting.

A fourth assumption is the dominant *efficient-choice* perspective (Abrahamson, 1991). Within this perspective it is assumed that adopters make rational choices guided by the tools of technical efficiency, and that free and independent choice is possible. This perspective assumes several things. First that the planned change position discussed below is a valid one, second that clinicians possess the autonomy to make choices in favour of research based practice, and third if they do have the ability to control their choices--they will choose in favour of research based practice. This perspective is somewhat similar to what Weiss (1979) characterizes as the *knowledge-driven* image of research utilization. This view originates with the natural sciences and has been the prevailing perspective on the development and use of "science" as knowledge. It assumes that "...the sheer fact that knowledge exists presses it toward development and use." (Weiss, 1979, p. 427). It is equatable with a "push" model of utilization in which science is produced and the clinician is expected to use it by virtue of its existence. Alternatively, a "pull" model would exist if clinicians demanded research that addressed problems with which they had to cope.

The fifth assumption, and the one on which nearly all of the work in nursing is premised, is that of *planned change*. The practice setting, as with most settings, grows increasingly unstable as knowledge expands, as technology advances, and as the social, political and economic world around us destabilizes. Increased sensitivity to the nature of the rapidly fluctuating practice context and to the action priorities of the nurses who primarily work there is essential if nurse investigators are to do meaningful work in this area. While it is probable that models based rigidly on planned change need to be reconsidered in our work on research utilization, alternative approaches to

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[6]This phenomenon is not unique to nursing, in fact it seems to be the preferred approach in the current clinical practice guideline movement in Canada and the United States that is occupying physicians, as well as, other health disciplines.

conceptualizing change have not been examined.

The final assumption is that the primary *knowledge needed for practice is scientific in nature*. The most compelling evidence of this in nursing is the absence from the research utilization studies of any definition of research other than as the findings of scientific studies. While Carper's (1978) *empiric* form of knowledge is undoubtedly critical to nursing practice it is not appropriate to continue to focus on scientific knowledge to the exclusion of other knowledge forms. Carper and others have made important contributions to our understanding of knowledge in nursing. Our need to address clinical use of more than *scientific* findings is likely to become increasingly apparent as we search for ways to expand on current conceptualization, and to reconceptualize research utilization.

Models

As early as 1976 Downs and Mohr put forward the idea that there was not a single theory of innovation, but that rather, different types of innovation require distinct theories. Thirteen years, and a considerable amount of research later Poole and Van De Ven (1989) contended that no single theory can encompass "the complexity and diversity of innovation processes" (p. 638). Other authors in the innovation literature who have reached the same conclusion include Damanpour (1987, 1991), Mohr (1987), Van De Ven and Rogers (1988), and Wolfe (1994a). The nursing literature does not yet reflect this awareness, and in fact, there is as yet, little call for theoretical work or for the sort of middle range theory that Rogers (1983) advocated over a decade ago. Current nursing literature does not yet reflect a broad range of work addressing the many complex interactions inherent in innovation diffusion and research utilization, but a tendency can be detected to search for the "right" model of research utilization. Given our "pluralism" debates of the 70's and 80's and the strong advocation by some of a unifying "grand" theory of nursing, caution may be advisable and frustration lessened if we take the counsel of theoreticians who have already determined the necessity of multiple theoretical perspectives.

Poole and Van De Ven (1989) also propose that criteria for good innovation theories be agreed upon and that meta-theoretical work proceed. We have seen no meta-theoretical work to date in nursing, or any suggestion that such work might be an important avenue of inquiry in innovation diffusion or research utilization. However, we have seen the development of several models of research utilization. These models differ from the kinds of models proposed in the non-nursing literature in that they tend to be prescriptive large-scale models (e.g., CURN), whereas the models in the non-nursing literature either (1) represent middle range theory (e.g., Warner, 1974) most commonly from the organizational innovation literature, or (2) are of a much more general nature usually related to knowledge utilization (e.g., Weiss' [1979] seven models of knowledge/research utilization).

The major research utilization models in nursing include: CURN (Horsley, Crane, & Bingle, 1978; Horsley, et al., 1983), WICHEN (Kreuger, 1977; Kreuger, 1978; Kreuger, Nelson, & Wolanin, 1978), NCAST (King, Barnard, & Hoehn, 1978), and Stetler/Marram (Stetler, 1985, 1994a, 1994b; Stetler & Marram, 1976). Lesser known models include the Dracup/Breu model (Dracup & Breu, 1977), the RNABC model (Registered Nurses Association of British Columbia, 1990), the Dissemination model (Funk, Tornquist, & Champagne, 1989a, 1989b), the Iowa model of research in practice (Titler, Kleiber, Steelman, Goode, Rakel, Barry-Walker, Small, & Buckwalter, 1994), the Horn Video Productions/Colleen Goode model (Goode & Bulechek, 1992), and Goode's systems theory model (Goode, Lovett, Hayes, & Butcher, 1987). Crane (1985a, 1985b) has discussed knowledge utilization models and analysed which underpin the major research utilization models in nursing. She proposes that WICHEN was underpinned by a problem solving model, NCAST by the classical diffusion model, and CURN by a linkage[7] model.

In the organizational innovation literature the following are examples of the types of models that can be found: a model of territorial rights and boundaries (Daft & Becker, 1978; Fennell, 1984; Morison, 1950; Shepard, 1967), a dual core model of innovation (Daft, 1978; Kimberley & Evanisko, 1981), the ambidextrous model (Damanpour, 1991), alternatives to an efficient choice model, such as fashion, fad, forced selection and bandwagon models (Abrahamson, 1991, 1993), and a Desperation-Reaction Model of Medical Diffusion (Warner, 1975). Generally, these models tend to focus on explanation, rather than prescription and tend to be quite circumscribed in the particular aspect of innovation diffusion they address.

In the literature of the social sciences, which focuses heavily on how research affects policy, Weiss' (1979) seven general models of research utilization represent another way in which models have been conceptualized. Her structure includes the knowledge-driven model, the problem solving model, an interactive model, a political model, a tactical model, an enlightenment model, and research as part of the intellectual enterprise of the society. She suggests that the knowledge-driven model (basic research → applied research → development → application) has dominated the natural sciences. Within this framework the simple existence of knowledge, or research, mitigates toward its development and use. In a problem-solving model, decisions that need to be taken drive the selection of the research to be done and used. Weiss maintains that although this is the prevalent notion of research utilization in the social sciences, it probably applies to a minority of situations; the requisite convergence of circumstances to permit research to directly affect a policy decision is unlikely to occur with any frequency. In an enlightenment model, the language of which has crept into nursing (see for example

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[7]Crane attributes both the problem-solving and linkage models to Havelock (1969, 1972). The linkage model was developed to integrate three other knowledge utilization models--social interaction and diffusion, problem solving, and diffusion (Crane 1985b).

Stetler's work), "...concepts and theoretical perspectives...permeate the policy-making....The imagery is that of social science generalizations and orientations percolating through informed publics and coming to shape the way in which people think about social issues." (Weiss, 1979, p. 429).

Nursing in the United States[8] began its research utilization efforts in the mid seventies. Those efforts (CURN, WICHEN, NCAST) were essentially of one kind--the launching of significant research utilization initiatives over a period of several years with major funding support. These projects are extensively referenced in the nursing literature, and have undoubtedly been influential in both raising awareness and informing theoretical development. It is against this backdrop of models, and theoretical perspectives and of assumptions mentioned earlier that the individual investigator or team must try and cast a fresh theoretical perspective on research in this field. To do so requires an appreciation of the current situation in nursing, as well as, an awareness of the assumptions and perspectives that have been briefly addressed.

Conceptual Issues: What is Research Utilization?

One of the significant problems in the literature on research utilization, knowledge utilization and innovation diffusion is the lack of definitional precision and the resulting conceptual confusion surrounding the central concepts in the field. This is compounded by the diverse terms used by different disciplines and by those working in different areas of the larger field. Backer (1991) identifies lack of definitional clarity as part of the serious challenge of fragmentation facing scholars in these fields in the 1990's.

At least two "sets" of terminology are prevalent. The first is found in the literature on innovation diffusion, especially in business and organizational analysis journals. The second is found in the less clearly defined field of knowledge and research utilization which is populated predominately by social scientists in the disciplines of sociology, psychology, education, and communications. While these two areas are not mutually exclusive as has been noted earlier, each does have a dominant lexicon. Nursing has drawn from both fields to form a hybrid lexicon--one that is not necessarily more conceptually clear and precise.

As a result of the differing terminology it is often necessary to use language alternative to the research utilization language of nursing in order to communicate productively. The terms used in these communications have found their way into nursing and are undoubtedly part of the vocabulary of the reader. Therefore, in this section the

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[8]As noted earlier, most of the work done in research utilization in nursing has been done in the United States. More recently the literature reflects increasing activity in the United Kingdom, including increased numbers of research studies. There has been little theoretical or empirical research conducted in Canada.

most common of these concepts are briefly addressed: dissemination, diffusion, adoption, implementation, utilization, and technology transfer drawing primarily on the ideas of Glaser, Abelson and Garrison (1983, p. 2-3), which also reflect the predominant presentations in the literature. A fuller discussion of knowledge and research utilization, of instrumental, conceptual, and symbolic utilization, and of innovation diffusion follows because the main definitional problem in the field is that of defining the *dependent variable,* that is research utilization and its "sound alikes."

Dissemination refers to the spreading of knowledge or research such as is done in scientific journals and at scientific conferences. It has its roots in library science and is concerned with getting information out to a wider audience (Backer, 1991). *Diffusion* also refers to the spreading of innovations, knowledge, and/or research to individuals, groups, organizations, and in some cases to society at large. Diffusion is a term usually used after there has been a decision to adopt an innovation. *Adoption* usually refers to the decision to adopt the innovation and has frequently been the dependent variable in innovation research. *Implementation* refers to the execution of the adoption decision, that is, the innovation or the research is put into practice. *Utilization* is focused on assisting with the actual adoption process after dissemination and diffusion have occurred (Backer, 1991), and on the adaptation, implementation, and routinization processes discussed by Havelock (1986). Routinization is an "embedding" process and is also described as internalization, integration, incorporation and institutionalization (Havelock, 1986, p. 25). *Technology transfer* is the communication and practical use of information; that information is often scientific knowledge (Dearing, 1993; Glaser, Abelson & Garrison, 1983). While not a term used in nursing, it could be; however, it is more common outside of the discipline, and will not be introduced here.

Knowledge Utilization

Knowledge utilization is defined at its broadest as the use of knowledge, regardless of the kind of knowledge. Backer defines it as including "research, scholarly, and programmatic intervention activities aimed at increasing the use of knowledge to solve human problems" (1991, p. 226). That is, knowledge may be, using Phenix's (1964) terms synoptic (philosophical, historical, religious), empiric, aesthetic, moral, synoetic (personal), or symbolic (discursive, non-discursive, mathematical). Alternatively, Carper (1978) suggested that in nursing knowledge could be classified into empirics (the science of nursing), aesthetics (the art of nursing), personal knowledge, and ethics (the moral component). The ends to which knowledge is used have been treated in a variety of ways. Eraut (1985) for example, considers that knowledge is created and used in three contexts: (1) the academic context where action has no part for only knowledge confers status, (2) the policy context which requires special social and political skills, and (3) the action context which entails a pragmatic orientation and where the aim is action. His work is useful because it is within the action context that clinicians use knowledge and with which I was most interested in this study.

Kerr (1981) offered an epistemological treatment of knowledge utilization sharply critiquing the bureaucratization and the professionalization of knowledge; advocating instead a Lakatosian/revised-liberal conception where knowledge develops competitively between research programs. That view is consistent with Fry's (1990) position in nursing that Laudan's problem solving approach to knowledge creation and use is of value to nursing. Kerr's work serves as a useful reminder that the dominant perspective within academic nursing--knowledge as professional or expert--is not immune to the need for reevaluation.

Larsen's (1980) treatment of knowledge utilization is one of the most useful. She considers knowledge utilization as "a complex process involving political, organizational, socioeconomic, and attitudinal components in addition to the specific information or knowledge" (1980, p. 424). Drawing on the work of Rich (1975, 1977), and Weiss (1979), she proposes that knowledge utilization can be classified as instrumental and conceptual. Larsen has also contributed to the classification of knowledge utilization, suggesting four categories of utilization: complete, partial, modified, not at all. Complete utilization is probably the exception, with partial and modified utilization being quite common and revealing of many of the dimensions of research utilization that we as yet do not understand. Beyer and Trice (1982) add to Larsen's conceptual and instrumental utilization, *symbolic* utilization. Hasenfeld and Patti (1992) in social work and Stetler (1994a, 1994b) in nursing have drawn this conceptualization of knowledge utilization into their respective fields and equated it with research utilization.

Research utilization

Research utilization is a specific kind of knowledge utilization where the knowledge, using Carper's classification, is primarily empirical in nature, but may also be aesthetic and/or ethical if those forms of knowledge have a research base to substantiate them. It is a complex process in which knowledge, in this case in the form of research, is transformed from the findings of one or more studies into possible nursing interventions, the ultimate goal of which is use in practice. Utilization, thought of in this way is similar to Kimberley's (1981) use, that is, it includes the post adoption and post implementation process. Usually we hope for a sustained practice change although this aspect has received almost no study in nursing. The research may or may not be translated into a *product*, that is, a material form such as a clinical protocol, a clinical decision algorithm, or the currently popular clinical practice guidelines. Research utilization--as opposed to innovation diffusion or technology transfer--is the preferred term in nursing, and in social work (Grasso & Epstein, 1992) and is the predominant term used in this study.

Stetler (1994a, 1994b; Stetler & DiMaggio, 1991) has drawn extensively from non-nursing literature (Dunn, 1983; Sunesson & Nilsson, 1988, 1993; Larsen, 1980; Weiss, 1979, 1980) and introduced instrumental, conceptual and symbolic utilization into nursing. Interestingly, with the exception of Tanner (1987), this has largely not been

followed through in the nursing literature. In *instrumental utilization* there is a concrete application of the research, and the research is normally translated into a material and useable form such as a protocol. The research in this case is used to make specific decisions/interventions. In *conceptual utilization* the research may change one's thinking but not necessarily one's particular action. In this kind of research utilization, the research informs and enlightens the decision maker (Hasenfeld & Patti, 1992), in this case the nurse. *Symbolic utilization* involves the use of research as a persuasive or political tool to legitimate a position or practice. Larsen (1980) added a classification system for the degree of utilization--complete, partial, modified, and not at all, although she did not specify whether this classification applied equally to each of the kinds of utilization.

Innovation Diffusion

An *innovation* has been defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." (Rogers, 1995, p. 11). An innovation is a more focused concept than research and usually implies that the research has been translated in some way into a concrete form that enables it to be introduced as a product to one or more individuals or a larger unit such as an organization (Horsely et al., 1983). Rogers defines *diffusion* as "the process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers, 1995, p. 5, 10). Innovation diffusion is more focused then, than research utilization and represents a particular kind of utilization concerned with the transfer of findings into a practice context. It is most closely related to instrumental research utilization. In the nursing literature the terms research utilization and innovation diffusion are frequently used synonymously, but it should be remembered that this is a usage specific to nursing. Innovation diffusion in classical diffusion theory does not imply that the idea, practice, or object resulted from a research study, whereas with research utilization that is precisely the implication. Further, the application of the instrumental, conceptual and symbolic modifiers is not congruent with innovation diffusion. The usage of the terms innovation and innovation diffusion have crept into nursing because nurse investigators have found Roger's (1983) diffusion theory useful--and that is the language of his work. Additionally, Horsley (1985) who has been very influential in the area of research utilization in nursing, has conceptualized knowledge as both process and product. The product is the "packaged" research findings in the form of a protocol which once it is in that form can be treated both conceptually and empirically as an innovation and diffusion theory applied.

The current context in nursing

The nursing literature on the topic of research utilization is primarily descriptive and anecdotal, few empirical studies have been conducted. Within the non-empirical literature are two categories, descriptive and theoretical literature. The descriptive

literature is characterized by:

1. Overviews and general analyses of the current situation specific to research utilization in nursing (Church & Lyne, 1994; Crane, 1985a, 1985b, 1995; Cronenwett, 1995; Edwards-Beckett, 1990; Fawcett, 1982, 1984; Funk, Tornquist, & Champagne, 1995; Gennaro, 1994; Gould, 1986; Horsley, 1985; Hunt, 1981; Lekander, Tracy, & Lindquist, 1994; Lindquist, Brauer, Lekander, & Foster, 1990; Pepler, 1995; Romano, 1990; Stetler, 1994a; Stonestreet & Lamb-Havard, 1994; Weiler, Buckwalter, & Titler, 1994)

2. Admonitions to practitioners, executives and educators to utilize the findings of scientific studies, or to researchers to make their studies clinically relevant and understandable to the practitioner (Akinsanya, 1994; Bircumshaw, 1990; Blegen & Goode, 1994; Brodie, 1988; Broines & Bruya, 1990; Closs & Cheater, 1994; Goode, 1995; Wilson-Barnett, Corner, & DeCarle, 1990). Additionally, while these articles specifically address the need to use research in practice, hardly an article written in nursing does not admonish the profession, or subsets of it, to use research in practice.

3. Descriptions of local initiatives geared toward implementing practice changes based on varying amounts of scientific evidence (Ashcroft & Kristjanson, 1994; Bostrum & Wise, 1994; Cole and Gawlinski, 1995; Davies & Lundrigan Simms, 1992; Forsythe, 1994; Gelhar, Kobler Miserendino, O'Sullivan, & Vessey, 1994; Hanson & Ashley, 1994; Kipnis, Turner, & Van Der Wal, 1992; Kite, 1995; Leske, Whiteman, Freichels, & Pearcy, 1994; Long, 1992; Longman, Verran, Ayoub, Neff, & Noyes, 1990; Maxwell, 1995; McGuire, Walczak, Krumm, Haisfield, Beezley, Reedy, Shivnan, Hanson, Gregory, & Ashley, 1994; McCollam, 1995; Olson (1992, 1993); Pepler (1992); Specht, Berquist, & Frantz, 1995; Titler, Greiner, Jones, Hauer, & Megivern, 1994; Turner & Weiss, 1994; Van Koot & Laverty, 1992; Vines, Arnstein, Shaw, Buchholz, & Jacobs, 1992).

This literature while bountiful, was of limited use in formulating the study. It does not provide new information to support the extent of, or the factors that may influence research utilization. When those areas are addressed it is usually a reiteration of information in the limited empirical studies available in nursing. Occasionally, authors draw on literature from outside of nursing (e.g., Romano, 1990) but this is not common.

In contrast, there is a remarkably small volume of theoretical literature, that is, literature which advances our conceptualizations of research utilization and which advances the development of research utilization theory. Two papers addressing the criteria by which research is judged ready for use have made important contributions (Haller, Reynolds, & Horsley, 1979; Tanner, 1987). Two papers addressing definitional issues (Loomis, 1985; Stetler 1985) have also made important contributions. Additionally, embedded within the work of the major research utilization initiatives in

nursing (e.g., CURN, WICHEN, NCAST) and within the work of some of the research utilization models (Stetler/Marram, 1976; Stetler, 1994b) there have been important contributions to our understanding of the complex *process* of research utilization. However, there has been little, if any, conceptual/theoretical work published addressing the factors which function causally to bring about or impede utilization, or to address the extent of research utilization. In the case of the extent of research utilization, we are in need of serious theoretical consideration of how it is that research utilization is both defined and operationalized. The failure to address this issue of the *dependent variable* (i.e., what is and how do we measure, research utilization) is one of the most pressing issues in the research utilization literature in nursing and one of the most significant problems facing us. It is followed closely by a need to begin to build cohesive mid-range theory dealing with the causal mechanisms of research utilization.

The empirical work in nursing (1972-1996): An overview

Thirty-five nursing studies were located dealing with research utilization in some manner. This group of studies address one of three basic questions: (1) what is the extent of research utilization? (2) what factors influence the utilization of research by the individual nurse, that is, what are the barriers and/or facilitators to research utilization? and, (3) how do we compel nurses to use research? This last question has just begun to be addressed by researchers using a variety of approaches, some of them descriptive or still quite preliminary (Rutledge & Donaldson, 1995; Tranmer, Kisilevsky, & Muir, 1995). In some cases it involves a quasi-experimental or experimental approach (Dufault, Bielecki, Collins, & Willey, 1995; Hodnett, Kaufman, O'Brien-Pallas, Chipman, Watson-MacDonald, & Hunsburger, 1996; Luker & Kenrick, 1992, 1995) to testing whether specific strategies exert an effect on research use and in one case on patient outcomes (Hodnett et al., 1996). Early results seem promising that research use can be increased using selected strategies, although the impact on outcomes has yet to be studied.[9] Also encouraging in these studies is the evidence of our ability to work toward using randomized controlled trials in some clinical areas, suggesting that early criticisms of inadequate pools of research studies are being addressed. These studies, while dependent on the kind of information that is brought to bear from studies addressing questions one and two, do not themselves directly bear on the dissertation study. The other two questions, especially the second, do however, bear directly on this study.

Eight of the remaining 29 studies--Capra, Houghton, and Hattie (1992), Hefferin, Horsley and Ventura (1982), Hunt (1987), Miller and Messenger (1978), Sellick, McKinley, Botti, Kingsland, and Behan (1996), Shore, (1972), Webb and Mackenzie (1993), and Wright, Brown and Sloman (1996)--make limited contributions to this review

[9] In the one study in which outcomes were assessed the hypothesized improvements that could be ascribed to the experimental group over time were not achieved (Hodnett, et al., 1996).

because their methods, analyses and findings are so sparsely or confoundingly reported. In the remaining 21 studies, one finds the study often addresses both the extent of research use and factors influencing it. A summary of these 21 studies specific to extent and factors influencing research utilization is provided in table 1.

The extent of research utilization

The extent of research utilization, that is, the extent to which practising nurses actually implement the findings of scientific studies into their practice is poorly understood. In a twenty year period, only eight studies in nursing have attempted to measure the extent of research utilization as the *primary goal* of the study. This is extraordinary when one considers the persistence with which authors in nursing have extolled the value of research utilization, while at the same time carefully registering the lack of research utilization by practitioners. The eight studies (Barta, 1995; Brett, 1987; 1989; Coyle & Sokop, 1990; Ketefian, 1975; Kirchoff, 1982; Michel & Sneed, 1995; Varcoe & Hilton, 1995) in which the investigators have attempted to measure the extent of utilization each used a survey design and predominantly descriptive techniques to analyse the resulting data. Of these eight studies, Ketefian's study should probably be excluded. Although it is frequently cited as evidence that nurses do not utilize research, Ketefian's findings[10] should probably not have been generalized *by others* in the way in which they have sometimes been, given her small, non-random sample (n=87).

Of the remaining seven studies published, Brett's two studies, in fact, represent different aspects of one study (her dissertation). Of the five studies remaining Kirchoff's (1982) study, despite methodological strength, represents an examination of coronary care precautionary interventions and so is very narrowly focused on one kind of patient in one context. Coyle and Sokop's study (1990) is a replication of Brett's work. Barta (1995) examined the level of research utilization among pediatric educators not clinicians. Michel and Steed (1995) deliberately used a sample with a high percent (49%) of master's prepared nurses to more closely examine the effect of educational level. Varcoe and Hilton (1995) measured general and specific research use among clinicians. Specific use was measured by using items from Brett's (1987) Nursing Practice Questionnaire (NPQ); their measure of general use was done by asking nurses to rate (from one to four, where four was always) their general use on ten non-specified statements.

Looking first at the three studies that had nurses from speciality sub-populations, Kirchoff reported frequencies for each intervention but offered no composite rating of extent of utilization, she did report that 24% to 35% of the sample (n=240) adopted one of the two main interventions she studied. Barta (1995), using an adaptation of Brett's

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[10]Ketefian reported that only one in 87 nurses surveyed knew the correct length of time for thermometer placement. Because glass thermometers were beginning to be replaced by electronic ones by the time this study was published, some have criticized the usefulness of the findings. The lengthy *lag times* often reported between the report of research and its implementation into practice probably diminished this concern.

Table 1. Summary of nursing studies examining extent of and/or factors influencing research utilization (RU).

Study	Extent of RU	RU Factors
Baessler et al., 1994	S	P
Barta, 1995	P	S
Bostrum et al., 1993	S	P
Brett, 1987, 1989	P	S
Capra et al., 1992	P	-
Champion et al., 1989	S	P
Coyle & Sokop, 1990	P	S
Fulton, 1996	-	P
Funk et al., 1991a, 1991b	-	P
Funk et al., 1995	-	P
Hefferin et al., 1982	-	P
Hunt, 1987	-	P
Ketefian, 1975	P	-
Kim & Kim, 1996	-	P
Kirchoff, 1982	P	S
Lacey, 1994	S	P
Michel & Sneed, 1995	P	S
Miller et al., 1978	-	P
Pettengill et al., 1994	S	P
Rizutto et al., 1994	S	P
Rodgers, 1994	-	P
Shore, 1972	-	P
Stetler et al., 1991	S	S
Varcoe & Hilton, 1995	P	S
Walczak et al., 1994	-	P
Webb et al., 1993	-	P
Winter, 1990	S	S

P=primary focus, S=secondary focus, - not addressed.

NPQ, the NPQ-E, reported a mean innovation adoption score of 2.98 which was interpreted as "include sometimes."[11] Michel and Sneed (1995) using an updated form of Brett's NPQ reported an overall mean innovation adoption score of 2.21 (persuasion stage).

Looking next at the three studies that used general nursing populations, Brett (1987) reported an average of 61% of her sample (n=279) "indicated the research finding was used at least sometimes" (p. 348). Brett asked nurses how often they used 14 nursing practices, determined to have sufficient scientific basis for implementation, using a five point scale (never=1, sometimes=3, always=5). Coyle and Sokop calculated an average adoption score for the same 14 practices of 1.96 (n=113), which they interpret as meaning that the "average nursing practice had diffused beyond the stage of awareness to the stage of persuasion" (p. 178). Brett's average adoption score was 2.17 which was also within the "persuade" stage. Barta (1995), using Brett's instrument and range of scores, and measuring eight practices, reported a mean total innovation adoption score of 2.98. Varcoe and Hilton (1995) obtained a mean score of 2.15 (n=183) after eliminating 30% of the findings that nurses had said were not applicable. Each of these investigators interpreted research utilization as strictly *instrumental* as evidenced by the items provided by Brett (1987).[12]

These studies in which a narrowly focused definition of research utilization as instrumental was used, in which only nursing research was considered, and in which a range of "adoption scores" (1.98 to 2.98) whose meaning is not clear were reported, represent the scientific basis for the ongoing claims in the literature that practising nurses do not use research in their practice. While they have made important contributions to our substantive and methodological understanding in this area, it is apparent that the profession has a significant amount of work to do before it can be confident of the extent of research utilization.

Factors influencing nursing research utilization

Factors influencing research utilization are discussed in detail in the following section which includes both nursing and non-nursing literature. In this section only a summary status of what we know at this point in nursing is provided to complete a brief overview of the nursing research conducted in this area in the past two decades. Several variables have been thought to influence the utilization of nursing research. These have primarily been individual variables. Brett (1987, 1989), Coyle and Sokop (1990), Funk, Champagne, Weiss, & Tornquist (1991b), and Varcoe and Hilton (1995) also examined or reported selected organizational variables. None of the studies located have included "innovation attributes", that is, variables describing the innovation or research protocol

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[11]Brett's stages of adoption were: unaware (0-0.49), aware (0.5-1.49), persuade (1.5-2.49), use sometimes (2.5-3.49), use always (3.5-4.0).

[12]It is not clear how Varcoe and Hilton (1995) conceptualized general research use, as they provide no information about this in their report. They conceptualized specific use as instrumental as evidenced by their use of Brett's items.

itself. The primary variables for which there has been at least some evidence for a positive effect on the utilization of nursing research have included: awareness of agency policy and educational level (Michel & Sneed, 1995)[13]; time spent reading particular professional journals (Barta, 1995; Brett, 1987, Coyle & Sokop, 1990; Kirchoff, 1982); conference attendance (Coyle & Sokop, 1990); cooperativeness and self-efficacy (Kim & Kim, 1996); job satisfaction (Coyle & Sokop, 1990); a positive attitude toward research (Bostrum & Suter, 1993; Champion & Leach, 1989; Lacey, 1994; Rizzuto, Bostrum, Suter, & Chenitz, 1994); involvement in nursing research activities (Bostrum & Suter, 1993); support of nursing administrators (Champion & Leach, 1989; Funk et al., 1991b), autonomy (Funk et al., 1991b; Lacey, 1994; Rodgers, 1994); the ability to see positive patient outcomes resulting from the research based intervention (Fulton, 1996); and adequate time at work to engage in research/research utilization activities (Funk, et al., 1991b; Rodgers, 1994; Pettengill, Gilles, & Clark, 1994). Some of these studies, most notably Funk et al. (1991b) support some of these variables by having identified a lack of them as barriers to research utilization.

The evidence for these variables is sparse and often equivocal. While Funk et al. (1991b) report that eight of ten of the top barriers to research utilization are organizational, Rizzuto et al. (1994) report that individual variables are more important determinants of research utilization than are organizational and other variables. Limited support is available for any of the organizational variables and there is no work relating to innovation variables in nursing. While most of the research in nursing has focused on individual variables even here several variables have either barely been addressed or have not been addressed at all. Examples include cosmopoliteness, affiliation (i.e., union, organizational, professional), personal beliefs, and perceived authority/autonomy of the nurse. Zaltman's (1979) work suggests that it would be unwise to ignore the abilities and attributes of the user of research. There are strong arguments to suggest that many factors influence research utilization. However, there is limited empirical support for most of them, and often support has been equivocal from study to study. In no studies located in nursing (and only in a very limited way outside of nursing) have the factors influencing research utilization or innovation diffusion been studied within the context of causal modeling. The value of a causal modeling approach is significant in a practice discipline interested in the development of predictive theory because it enables the uncovering of the formal structures underlying complex conceptual structures.

Factors influencing research utilization: Nursing and non-nursing

The factors that influence research utilization can be grouped into three categories: organizational factors, innovation factors, and individual factors. Environmental factors are not addressed in this review except tangentially. When the environment is mentioned it refers to a broader context than Meyer and Goes' (1988)

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[13]These investigators deliberately recruited a sample with a high (49%) proportion of nurses with master's degrees, and some with doctoral degrees.

treatment of environmental variables, for example. The environment was considered beyond the scope of this study, although its influence is acknowledged. Individual factors are the primary focus of this study. Organizational and innovation factors will be addressed because data on selected variables from these two categories were collected for future analyses, and they are important to a more complete understanding of research utilization.

Organizational Factors

Organizational factors are those factors, often characteristics of the organization, thought to influence the diffusion of innovations or the utilization of research by practitioners. They have largely been the concern of those who contribute to the business, and in particular, the organizational analysis literature. I identified six factors from that literature that may influence innovation diffusion, and by extension research utilization: complexity, centralization, size, presence of a research champion, traditionalism, and organizational slack. Data were collected on four of these: size, presence of a research champion, traditionalism, and organizational slack. Additionally, nursing studies have resulted in the identification of an additional four organizational factors that may influence research utilization: time, access, and a supportive climate for nursing research, including infrastructure. Data were also collected on these four factors. Recently, Scott and Bruce (1994) in an analysis of a path model of individual innovation identified four additional organizational factors with significant effects: leader role expectations, leader-member expectations, support for innovation, and resource supply. Data collection on their support and resource factors was incorporated into data collection on the eight factors identified above.

Neither of the factors excluded from this study--organizational complexity and centralization--have been addressed in nursing. Organizational complexity which has been studied by investigators such as Damanpour (1996), Meyer and Goes (1988), Mohr (1969), and Orlandi (1986) is considered by Damanpour (1987) to consist of functional differentiation, specialization, and professionalism, where functional differentiation is the extent to which an organization is divided into different units, specialization represents the different specialists found in the organization, and professionalism reflects professional knowledge of the members requiring both education and experience (p. 679). In a later meta-analysis Damanpour (1991) demonstrates that these factors are generally positively associated with innovation diffusion in organizations. However, the primary intent of this study was not to explore the organization as the unit of analysis. Additionally, since the unit of analysis was the individual nurse and since nurses by and large are employed in similar organizations that are generally well differentiated, professional, and with some degree of specialization--the construct of complexity was not likely to hold much explanatory value or to be central to this study.

Centralization, studied by Kimberley (1981), Kimberley and Evanisko (1981),

and Moch and Morse (1977) is generally considered to exert a negative influence on the adoption of innovations. This negative effect was supported by Damanpour in his 1991 meta-analysis. The logic of this direction is that centralization of authority and decision-making generally inhibits innovative thinking and behaviour. To adequately determine the degree to which an organization is centralized would have involved collecting data beyond the scope of this study such as organizational charts, administrative input and clinician perceptions. It should be noted that this is a useful avenue for study at a later time since we do have some anecdotal evidence in this province that there are organizational differences in innovative behaviour among nursing departments and individual groups of nurses. Whether those differences extend to the use of research findings in practice is unknown.

While the unit of analysis in this study was not the organization, but rather the individual nurse, it was nevertheless appropriate to collect organizational data on selected factors for a number of reasons. First, there was an opportunity to collect important data that will be useful to ongoing theory development without unnecessary respondent burden and with little additional cost. Second, some of these factors have had beginning work done on them in nursing and it would be useful to try and advance that work. Third, I anticipate utilizing these factors in later analyses and in possible development of new and/or alternative models. Finally, there is evidence that, at least for those nurses who work in organizations, that the influence of those organizations on the individual cannot be entirely ignored. In the discussion that follows supporting literature is cited when there is some scientific evidence that the factor has influenced the utilization of research or diffusion of innovation. In the nursing literature this often means that little support is available because of the limited number of studies conducted. No attempt is made here to specify levels of significance, reliability and validity of instruments or other specific methodological information to the reader. In the nursing literature it is safe to say that all of the findings are tentative. While Brett (1987, 1989) and Funk et al. (1991b) have produced more sophisticated studies and reports than most, their work is still tentative because the pool of work in this area is so small.

Organizational size. Organizational size is generally thought to exert a positive influence on the adoption of innovations, i.e., the larger the organization, the more adoption of innovations there will be (Damanpour, 1987; Germain, 1996); Kimberley & Evanisko, 1981; Meyer & Goes, 1988; Moch & Morse, 1977; Mohr, 1969; Zmud, 1984). Mohr (1969) in his study of health units, points out that size probably reflects other variables such as presence of motivation, obstacles and resources. Rogers (1983) concurs and suggests that, while size is probably frequently studied because it is easy to obtain and relatively precise, rather than studying this surrogate variable investigators should seek to uncover its underlying structure. In nursing, Brett (1987, 1989) reported no relationship between size of the hospital and adoption of innovations by nurses. Varcoe and Hilton (1995) reported that organizational support and expectations about research use differed according to size.

Innovation/research champion. The presence of an innovation/research champion is consistently considered to exert a positive influence on the adoption of innovations and the utilization of research (Chakrabarti, 1974; Howell & Higgins, 1990; Markham, Green, & Basu, 1991; Schon, 1963). As Wolfe (1994b) points out most of these studies have examined the presence of a champion, but have not examined the relative importance of the champion in relation to organizational context, or included an examination of the influence of the power of the champion within that context. Anecdotal evidence provided by nurses holding nursing research positions in large hospitals, and my own experience supports the importance of the research champion in the context of organizations.

Traditionalism. Little is written about the variable of traditionalism. Mohr (1969) and Downs and Mohr (1976) briefly mention traditionalism with the perspective that the less traditional an organization the more likely it would be to innovate. Similarly, Scott and Bruce (1994) in discussing organizational climate infer that more creative organizations (i.e., less traditional) facilitate more innovation. Finally, in Rogers' (1983) work the implication that innovative organizations are more creative and flexible (i.e., less traditional) is present. Particularly, in the present climate of reform and what some describe as "unfreezing" it may be particularly useful to obtain some measure from the perspective of clinically practising nurses of the degree to which their organizations are traditional or non-traditional, and the degree to which that factors into their utilization of research.

Organizational slack. Organizational slack refers to uncommitted resources in the system (Damanpour, 1987, 1991; Fennell, 1984; Kimberley, 1981; Mohr, 1969; Zaltman, Duncan and Holbek, 1973; Rogers, 1995). It has been traditionally accepted that more innovation occurs and is possible in organizations with higher levels of *slack*. The invention of 3M's "yellow sticky" is frequently given as an example of an idea that went on to be a highly successful innovation as a direct result of organizational slack. I expect that there is little in the way of slack in most health organizations in the 1990's. Further, nurses have never felt the benefit of slack in the same way that employees in the private sector have. For one, the structural constraints that operate on the delivery of nursing care in hospitals and other health organizations has not resulted in slack being experienced at the point of care delivery. Also, it has not been normative behaviour in organizations to encourage staff nurses to think/be creative/invent or otherwise engage in innovative behaviour during planned or unplanned activities. When there has been down time, nurses have not regularly been able to make productive, measurable use of it.

Time. In the nursing research literature, lack of time is consistently reported as having an adverse effect on research utilization (Funk, Champagne, Wiese, & Tornquist, 1991b; Lacey, 1994; Miller & Messenger, 1978; Pettengill, Gilles, & Clark, 1994; Rizutto, Bostrum, Suter, & Chenitz, 1994; Rodgers, 1994; Walczak, McGuire, Haisfield, & Beezley, 1994). Little has been written to explain what is meant by the concept of *time* to nurses generally, or more specifically within the context of research utilization. The

only non-nursing study located that addressed time was done on municipal level environment and health officers in Sweden (Tydén, 1996). Tydén discusses the complexity of the time (or more accurately, lack of time) as a variable in research utilization studies at some length. Time *may* mean the following to nurses who have acted as subjects in the cited studies: designated on the job time during which the nurse is encouraged to and does engage in activities related to research and research utilization. Such time would ideally have certain characteristics: it would be "replaced" time, so that the nurse's patients received the same level of care in her absence, thereby eliminating "activity or role conflict" for the nurse; it would be adequate to complete a discreet undertaking and so would most likely occur in time segments such as four or eight hours; it would be "optimum time" so would probably occur on day or evening shifts, rather than night shifts; it would be facilitated time in that there would be guidance to ensure the activity was done efficiently and resulted in a tangible product. These characteristics or attributes of time are speculative and may be unrealistic. The work of nurses is not structured to permit the kind of activity that would advance either knowledge development or knowledge use. Organizations, at least hospitals, instead structure the work of nurses to produce a product--economical, efficient delivery of services.

Access. Access to research including findings, studies, libraries, and other sources has also been consistently identified in nursing as important to the utilization of research (Champion & Leach, 1989; Funk et al., 1991b; Pettengill et al., 1994; Walczak, et al., 1994). Certainly, it seems self-evident that clinicians require access to research literature. This assumption is premised on beliefs such as, most research consumption will or should occur at work and research in published report form is relatively usable. Forms other than the institutional paper-based library have not yet received much attention in the research utilization literature. As technology and the "information super highway" make their way into the lives of everyday citizens this will increasingly change. This concept of access is also predicated on the traditional *dissemination* approach to research utilization which assumes that if it is published it will be used.

Autonomy. Professional autonomy was strongly supported by Rodger's (1994) recent qualitative study, and has been also been supported by Funk, et al. (1991b), Lacey (1994), and Walczak, et al. (1994). These investigators were not entirely clear whether they were addressing organizational, professional, and/or individual autonomy. The importance of professional autonomy is probably underestimated in the empirical literature because it has hardly been studied. On a common sense level it seems entirely likely that if a nurses does not have, or does not perceive she has autonomy, and the authority to make decisions or change practice, that she would not be likely to do so regardless of whether a change was research based or not. If this factor has distinct individual, professional, and organization dimensions--or is in fact two or three variables--then increasing our understanding of it is essential, as one or more of these dimensions may be more amenable than others to change.

Support. Support is a factor that is composed of several variables. Nurses have identified that the following kinds of support are important to the utilization of research within the context of their workplace: peer support (Pettengill et al., 1994), support of nursing leaders/administration (Pettengill, et al., 1994; Funk, et al., 1991b; Rodgers, 1994), support of other members of the health care team such as physicians, physiotherapists, etc. (Lacey, 1994; Rodgers, 1994), and a supportive infrastructure for nursing research (Champion & Leach, 1989; Rizzuto, et al., 1994; Rodgers, 1994). Another variable hinted at by Rodgers (1994) is the presence of an immediate supervisor who is, in fact, a nurse.

The innovation

Two things make our understanding in nursing of the effects of the innovation itself (i.e., the research) on its utilization weak. First, unlike innovation diffusion researchers and organizational analysts, investigators and others in nursing have paid little attention to attributes of the innovation, that is, the characteristics of different kinds of nursing research, in terms of how the different kinds of research may influence nurses' use of it. Second, we do not know to what extent research as a product mimics the behaviour of other innovations. In nursing, the concepts of innovation diffusion have been readily incorporated into conceptualizations of research utilization as if they were synonymous, but there is little evidence or theoretical discussion in this regard. It seems logical that some of the attributes of innovations that have been considered to be important are also likely important attributes of nursing research. Those attributes that are readily understandable as logical choices or for which there is some evidence in nursing were included in data collection for the study.

There are numerous classification schemes used in the innovation diffusion literature to describe innovations. Three of the most common are: radical vs. incremental, administrative vs. technical, and product vs. process (Damanpour, 1987, 1988; Dewar and Dutton, 1986; Meyer and Goes, 1988). In this study the research that nurses use, that is, the innovation, was considered to be: (1) radical *or* incremental, in that it may result in a major change in practice or a more gradual change, (2) technical, in that the research addresses the basic work activity of the nurses, and is not directly related to management activities, and (3) primarily a product of research.

As Tornatsky and Klein (1982) pointed out in their meta-analysis of innovation characteristics, Rogers (1983) probably overstated his list of innovation characteristics as definitive, and Downs and Mohr (1976) probably overstated the bleakness of any probability we would ever be able to understand innovation characteristics in anything but a contextually bound way. Tornatsky and Klein also report much more equivocality than Rogers' work suggests. Rogers (1983, 1995) proposed the following list of innovation attributes thought to be important to their diffusion and adoption and which have been widely cited and studied since: complexity, relative advantage, compatibility,

trialability, observability. Van De Ven (1986) suggested authenticity, functionality and flexibility as additional attributes. Kimberley (1987) reviewing innovation diffusion within the context of magnetic resonance imaging (MRI) suggested that six attributes related to the degree of uncertainty and risk the innovation (MRI) represented were important: clinical efficacy, economic viability, performance characteristics (reliability, durability, serviceability), obsolescence horizon, production issues (in this case specific to producing the magnet component of the MRI), and regulatory activity (related to payment for services, federal and state regulations limiting the number of MRI's in a region). Recently, Dearing and Meyer (1994) identified economic advantage, effectiveness, observability, trialability, complexity, compatibility, reliability, divisibility, applicability, communality, and radicalness as eleven essential attributes of innovations.

Of the innovation characteristics mentioned above, the five suggested by Rogers (1983) seemed likely to bear on the utilization of research by nurses. These are briefly described as follows:

- *complexity*: the degree to which an innovation is perceived as relatively difficult to understand and use, higher complexity is associated with lower utilization.

- *relative advantage*: the degree to which an innovation is perceived as being better than what it replaces.

- *compatability*: the degree to which an innovation is perceived as consistent with values, experiences, and need.

- *trialability*: the degree to which an innovation may be experimented with on a limited basis. The more trialable an innovation, the less uncertainty, and the more utilization.

- *observability*: the degree to which the results of implementing an innovation are visible.

Based on the work of Rodgers (1994) and Walczak et al. (1994), and the investigator's own experience, *relevance* (the degree to which research is applicable to the nurse's practice) was added to this list. It may be that relevance is a component of what Rogers (1983) was referring when he proposed compatability, however, it is of sufficient importance to constitute a separate variable. It is clear that nurses have little interest in or motivation to use research that is not directly related to their practice.

The importance of understanding research attributes that will facilitate increased utilization lies in our subsequent ability to develop more appropriate vehicles for the research that we wish to see disseminated, diffused, and utilized by nurses, and processes by which this may be done. It is also predictable that conclusions about the kind of research that clinicians want and need might be drawn from the results of studies that

address innovation characteristics.

The individual

Although Scott and Bruce (1994) have proposed the only model I have located of *individual innovation*, very few individual variables are included in it. Most of their focus is on organizational variables such as resources and support. Not surprisingly, there is greater support for the study of individual characteristics in the social sciences (especially psychology) literature than in the organizational analysis literature (see for example, Cohen, Sargent, & Sechrest, 1986; McKee, Wit, Elliott, Pardue, & Judycki, 1987; Morrow-Bradley, & Elliott, 1986). Additionally, support can be found in the work of Weiss and Bucuvalas (1980a) and Zaltman (1979), and scattered throughout various of the better conceptual pieces on innovation diffusion and knowledge utilization (Van De Ven, 1986 on managing attention for example). In nursing, Rizzuto et al. (1994) make a strong case for study of the individual factors that may influence research utilization.

Rogers (1995) grouped adopter characteristics into three categories: (1) *socioeconomic characteristics* (education, social status, income, social mobility, literacy, age, favourable attitude toward borrowing money, etc.), (2) *personality variables* (empathy, dogmatism, ability to deal with abstractions, rationality, intelligence, positive change attitude, ability to cope with uncertainty, favourable attitude toward education, optimism/fatalism, high levels of achievement motivation), and (3) *communication behaviour* (social participation, interconnected social systems, cosmopoliteness, change agent contact, contact with interpersonal communication channels, knowledge of innovations, high levels of opinion leadership, part of highly interconnected systems). Many of these variables are not relevant in a consideration of nurses and research utilization because they are drawn primarily from the agricultural extension model of innovation diffusion. However, some of them are useful and others of them can be adapted to take on meaningful interpretations for a nursing context.

Although there is little evidence in the nursing studies that any of the traditionally collected demographic variables (e.g., age, sex, education, income) exert a particularly strong or directional influence on research utilization, they are frequently cited in nursing and non-nursing conceptual literature as relevant. Since they are easily obtained, they were collected along with other related variables such as: time since last education (basic, graduate, and /or specialized), years working, job title, clinical speciality, shift usually worked, hours per week worked, number of children at home and ages, marital status, dependent care responsibilities such as an elderly parent, extracurricular leisure and lifestyle activities (e.g., athletics, volunteer activity, political activity, community service, etc). Other variables that have been shown in some studies to be relevant were also collected. These included: number of research or short courses taken (Mohr, 1969; Rizzuto et al., 1994), involvement in research activities (Bostrum & Suter, 1993; Pettengill et al., 1994), amount and kind of reading (Brett, 1987; Coyle & Sokop, 1989;

Kirchoff, 1982), and job satisfaction (Coyle & Sokop, 1990).

Activism. In 1969 Mohr defined activism as "the health officer's perception of the extent to which the role of local health officer requires interaction with others, especially outside the health department, to obtain ideas, support, approval, and resources for departmental programs" (p. 115). While Mohr's health officers in three states and one province represent individuals with very different roles than practising nurses, especially those in hospital settings, the variable is nevertheless of interest to an understanding of nurses and research utilization. I expected that this variable if operationalized appropriately (e.g., as the nurses's perception of the need for political interaction to achieve an identified goal) would be informative at least regarding the symbolic utilization of research. It may be that activism has both professional and civic elements.

Affiliation. Work on territorial rights and boundaries (Daft & Becker, 1978; Fennell, 1984; Morison, 1950; Shepard, 1967), and on organizational commitment (Lewis & Siebold, 1993) suggests that individuals may have an primary affiliation to one or another organization. In the case of nurses this might be to the labour union, the organization (and/or a unit within the organization), or to the professional body. I originally thought that affiliation with a union would decrease research utilization, affiliation with the profession would increase it, and affiliation with the organization would probably decrease conceptual and symbolic utilization, but may or may not affect instrumental utilization depending on the presence in the organization of supportive research structures, a research champion, and other related factors.

Attitude. A positive attitude to research has been consistently associated in nursing with increased research utilization (Bostrum & Suter, 1993; Champion & Leach, 1989; Lacey, 1994; Rizzuto et al., 1994). Other studies have reported generally positive attitudes toward research (Alcock, 1990; Sellick et al., 1996; Varcoe & Hilton, 1995; Wright et al., 1996).

Autonomy. Similarly, higher levels of autonomy have been positively associated with increased research utilization (Funk et al., 1991b; Lacey, 1994; Rodgers, 1994). Sometimes this has been expressed as control over one's own practice, or as having the authority to make practice changes. In the case of practising nurses it has often been that a lack of autonomy has been considered a barrier to research utilization. Rogers suggests that fatalism--the degree to which an individual perceives a lack of ability to control his or her future--has been shown to demonstrate a strong negative effect on innovation behaviour (1983, p. 258). I believe this variable is similar to autonomy.

Belief. Rodgers (1994) has suggested in her qualitative work that for research to be utilized, it must be congruent with the personal beliefs of the nurse. While she does not expand on what those beliefs might be, it can be construed that they might originate in such places as the home, secondary school, nursing school, or graduate school. An

interesting situation is one where the knowledge acquired in nursing school is not congruent with current scientific evidence. If this were the case it might imply that knowledge acquired in nursing school "persists" and is stronger in influencing decisions and actions than is contemporary scientific evidence. Such a scenario would have implications for the profession.

Cosmopoliteness. "Cosmopoliteness is the degree to which an individual is oriented outside the social system" (Rogers, 1995, p. 274). It was originally measured as the number of trips Iowa farmers made to Des Moines (Ryan & Gross, 1943). The more cosmopolite an individual, the greater and earlier will be their innovation adoption. More recently, Gingiss, Gottleib and Brink (1994) operationalized it as: membership in a professional organization, attendance at a professional meeting, and routine reading of a professional journal. In their work on health innovations in schools, professional involvement, which these three items measure, was considered a major component of cosmopoliteness. Cosmopoliteness was positively correlated with innovativeness (the dependent measure). In nursing, Crane (1989) examined cosmopoliteness and found it positively correlated with research utilization, but it has not been otherwise studied in nursing, although it is frequently cited as being important. Kaluzny, Glasser, Jay, Gentry, and Sprague (1979), Kimberley, (1981), Kimberley and Evanisko (1981), and Mohr (1969) all working within some dimension of a health care system have suggested or reported actual positive associations between cosmopoliteness and innovation adoption.

Dogmatism. Jacoby (1971) studied dogmatism, and found a positive association between low levels of dogmatism and innovative behaviour. Although Jacoby does not clearly define dogmatism, it can be inferred from his discussion that people who score high on dogmatism are resistant to change and close-minded. He describes dogmatism as a functional characteristic in that the "more persistently anxious or threatened the individual, the more he maintains a closed mind" (p. 244). It is probably closely related to resistance to change and conservatism. Conservatism implies that individuals are more traditional and resistant to change (Mohr, 1969; Gingiss, et al., 1994). Mohr has suggested that it exists on a conservatism-liberalism continuum. Higher levels of conservatism are associated with less innovation adoption. Additionally, Rogers (1983) provides evidence that dogmatism is a relevant variable. The ability to cope with uncertainty and *risk* has been cited by Kimberley (1987), Rogers (1983), and Warner (1974) as important to successful innovation. Tolerance for uncertainty and the willingness to take risks seem logically related to both dogmatism and conservatism. In fact, these each likely tap the same concept. So, if one were intolerant of risk, one would be intolerant of uncertainty, more close minded, and more traditional. I believe uncertainty and risk can be conceptualized as elements of dogmatism.

Problem Solving Style. Scott and Bruce (1994) identified problem solving style (i.e., intuitive vs. systematic) as an important variable in influencing innovation. It has not been examined in nursing although one could argue fairly convincingly that nurses

who relied primarily on an intuitive approach would utilize research less, at least instrumentally. This is probably also related to the sources of knowledge used by nurses--preliminary evidence suggests that the top three sources are the patient/client, personal experience, and what was learned in nursing school (Baessler et al, 1994). This is also consistent with the findings of the psychologists.

Theoretical orientation. Morrow-Bradley and Elliott (1986) report that "the strongest, most consistent correlate of research utilization was theoretical orientation; behavioural (including cognitive) therapists reported finding therapy research more useful, whereas dynamic therapists found it less useful" (p. 191). Cohen et al. (1986) also support this idea. The idea of a theoretical orientation influencing research utilization has not been explored in nursing, but is intriguing. If there are nurses who are adherents of a particular theorist (e.g., Sr. Callistra Roy, Martha Rogers, Immogene King, Dorothea Orem, Rosemary Parse, Jean Watson, etc.) or who would more generally describe themselves as adhering to a theoretical perspective (e.g., adaptation, expanding consciousness, goal attainment, self-care, simultaneity, caring, etc.)--would this influence their utilization of research? While to my knowledge this area has never been pursued within the context of research utilization it holds potential to be informative although theoretical orientation as measured by adherence to a particular nurse theorist position is somewhat different than a psychologists' adherence to either a behavioural or a dynamic perspective.

Trust. Holzner and Fisher (1979) define trust, within the context of social structure and trust in knowledge, as "the diffuse, taken for granted belief that concern with risks can be properly and reasonably neglected" (p. 223). It is of some potential importance to nursing because in order to believe that risks can be justifiably neglected, the nurse has to trust that the experts or the elite (to most practising nurses) nurse scientists are able to produce not only relevant, but also valuable knowledge. In nursing, we have a long tradition of skepticism that those in the academic setting can produce much of value to nurses in the "practice setting."

Sources of Knowledge. The sources of knowledge that nurses use should correlate closely with the extent to which they use research. To some degree this is self-evident--if a nurse identifies nursing research journals as her primary source of the information needed to practice she is likely to use research to a greater extent than someone who identifies the patient as her primary source of knowledge or information. Baessler et al. (1994) examined sources of knowledge in nursing and found that sources we would traditionally associate with research (e.g., journal articles) rated lower than all other sources. Additionally, Cohen et al. (1986) and Morrow-Bradley and Elliott (1986) in psychology and McKee et al. (1987) in education report findings suggesting that knowledge source is an important predictor of research use. Except for Baessler et al. source of knowledge has not been explored in research utilization studies in nursing.

Summary

The literature reviewed presented a brief historical perspective, a discussion of assumptions and models found in the literature, an assessment of the current context in nursing, and a review of factors thought to influence research utilization--with an emphasis on influence in nursing. From this review a number of inferences were drawn.

First, while there is a large literature addressing models of research utilization, in nursing, for the most part, investigators have not studied the processes inherent in research utilization. In this literature a number of beliefs and biases have operated to influence, perhaps unknowingly, the investigators. This study did not attempt to address process, but I did attempt to not introduce these biases.

Second, the failure to address definitional issues and in particular, the issue of the *dependent variable* (i.e., what is and how do we measure, research utilization) is one of the most pressing issues in the research utilization literature in nursing and one of the most significant problems facing us. In nursing, as in other fields, the lack of conceptual clarity has made it difficult to compare studies or to build theory. In this study conceptual clarity was sought, and measurement of the dependent (and other) variables explicitly addressed.

Third, the definitional problems are followed closely by a need to begin to build cohesive mid-range theory dealing with the causal mechanisms of research utilization. It is apparent that there is not one "grand" or integrating theory of innovation diffusion or research utilization. Consequently, this study attempted to develop and test a limited mid-range theory related to the individual factors that influence (cause) research utilization.

Fourth, little is understood about the *real* extent of research utilization. In fact, the question of whether knowing a meaningful index of utilization would be useful has not been raised. However, in this study it was assumed that extent is of interest, can be estimated, and that it can be more productively estimated using a broader conceptualization of research utilization than has been taken to date.

Finally, many factors have been identified as influencing research utilization. However, there is limited empirical support for most of them, and often support has been equivocal from study to study. No one of the three main categories of factors (individual, organizational, innovation) has been well studied in nursing, although more work has been done on individual factors than on the others. In no studies in nursing (and only in a very limited way outside of nursing) have the factors influencing research utilization or innovation diffusion been studied within the context of causal modeling. The value of a causal modeling approach is significant in a practice discipline interested in the development of predictive theory.

Chapter 3

Theoretical Framework

Mid-range research utilization theory is virtually non-existent in nursing or in the health professions more widely. When nurse scientists have conducted studies in research utilization they have most frequently imported or borrowed heavily from others, most notably the work of Rogers (1962, 1971, 1983, 1995). As is common in our field these studies have not been constructed specifically to put Rogers' or others' theories to an empirical test. Rather, they have been constructed to examine either the extent of research utilization or the factors influencing it. The utility of the theory used has been in its ability to offer guidance about what stages or concepts to measure, and to offer some explanatory value in interpreting the results of studies. Assumptions underlying theories that have been derived in radically different contexts, and how those assumptions might influence findings in nursing, have not generally been examined. Correspondingly, I found little evidence in nursing of focused theory building, concomitant theory testing, or research programme development in the area I would describe as *research utilization* theory for nursing. My intent in this dissertation has been to begin work on the development of mid-range research utilization theory in nursing. I approached this task by first, spending an extended period reviewing relevant literature in this area. From this I was able to conceptualize the larger field that I thought was relevant to nursing, to identify areas within it, and to identify a more focused area of theory development specific to the individual that was potentially manageable within the confines of a dissertation and additionally, was a logical starting place in the field. Second, I constructed tentative models that specified the particular concepts that I thought should influence the outcome, research utilization. Third, using structural equation modeling and data from the Research Utilization Survey (the survey questionnaire developed for data collection in this study), I further developed and assessed these models.

In this chapter the work of constructing the original theoretical framework that guided planning of the study, the development of the survey questionnaire and the initial analysis is described. Each of chapters five through eight is another chapter in theory construction within the context of this study. A *final* theory and accompanying theoretical framework is not a product of this study. I would not expect a more mature theory that had withstood several empirical tests to be available for some years to come. While it may be that the theoretical work in this (as with most other fields) will never be complete, I am confident that research utilization theory will be successfully developed and used to meaningful ends--and that the work in this study is a good beginning toward

that end.

My search for grounding in this area began in the literature which was reviewed in chapter two. From that review I determined that one of the most significant problems in the literature on research utilization and related concepts was the lack of definitional precision, particularly relating to the *dependent variable*, that is research utilization and its "sound alikes." The lack of precision is compounded by the diverse terms used by different disciplines and by those working in different areas of the larger field. Research utilization, as opposed to knowledge utilization, innovation diffusion or technology transfer, has been the preferred term in nursing. In this study I have primarily used the term research utilization; to a lesser extent the term research use is also used synonymously. Because definitional problems are so pervasive, some care is taken here to theoretically define, (1) terms that are used generally in the literature; which while they do not appear in the specific models do occur throughout the various chapters, and (2) those terms which appear in the specific models of this study.

This first set of terms is defined below before proceeding to a discussion of a theoretical framework as it applied in this study:

- *Adoption* usually refers to the decision to adopt the innovation and has frequently been the dependent variable in innovation research.

- *Diffusion* refers to the spreading of innovations, knowledge, and/or research to individuals, groups, organizations, and in some cases to society at large.

- *Dissemination* refers to the spreading of knowledge or research such as is done in scientific journals and at scientific conferences.

- *Implementation* refers to the execution of the adoption decision, that is, the innovation or the research is put into practice.

- An *innovation* has been defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." (Rogers, 1995, p. 11). It does not have to be research based. Innovation when used within the context of research utilization in nursing, usually implies that the research has been translated into a concrete form (e.g., protocol) that enables it to be introduced as a product to one or more individuals or a larger unit such as an organization (Horsely, 1983). The term innovation is common in the nursing literature, but was not used in the data collection instrument in an attempt to limit any confusion.

- *Innovation diffusion* is "the process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers, 1995, p. 10). In the nursing literature the terms research utilization and innovation diffusion are

frequently used synonymously; this usage is specific to nursing. Innovation diffusion in classical diffusion theory does not necessarily imply that the idea, practice, or object resulted from a research study, whereas with research utilization that is precisely the implication. Further, the use of adjectives such as instrumental, conceptual and symbolic, which appear later in this chapter is not congruent with innovation diffusion. When innovation diffusion is used in nursing it usually represents instrumental research utilization, i.e., is concerned with the transfer of a research based protocol to a practice context.

- *Knowledge utilization* is defined at its broadest as the use of knowledge, regardless of the kind of knowledge. That is, knowledge may be, using Phenix's (1964) terms synoptic (philosophical, historical, religious), empiric, aesthetic, moral, synoetic (personal knowledge), or symbolic (discursive, non-discursive, mathematical). Alternatively, Carper (1978) suggested that in nursing, knowledge could be classified into empirics (the science of nursing), aesthetics (the art of nursing), personal knowledge, and ethics (the moral component).

- *Technology transfer* is the communication and practical use of information; that information is often scientific knowledge that is technological in nature.

Model (Theoretical Framework) Development

In this study and generally, I am interested in developing formal theory, that is, theory that is directly connected to the empirical world and which is testable. With this as an objective, verbal descriptions of theorizing become quickly inadequate (and I would propose are generally inadequate). What is required are models with mathematical implications to accompany the verbalizations. In fact, verbal *theory* and mathematical *model* should become unified. In this chapter and throughout this study's progression I have considered model development as synonymous with theory development. This clarification is of some importance in a discipline whose recent history reflects two decades of *grand theorizing* in which there was little or no requirement for theoretical verbalizations to be connected to mathematical models with rigid empirical implications.

Model construction in this study was done in a three-step process because the state of knowledge in this area permitted only speculative determination of a causal structure with which to begin. I located no other attempts in the *nursing* literature to model the causal structures of research utilization. The *process* of research utilization is often represented in a diagram (see for example Stetler, 1994b) but those are not causal models. Modeling outside of nursing has usually involved complicated mathematical models of innovation (Abrahamson, 1993), in particular the *S* curve of innovation adoption (Rogers, 1983). The only causal modeling using LISREL located similar to that attempted here was done by Scott and Bruce (1994) outside of nursing. Originally, I had expected to keep such basic principles of sound model construction as focus, parsimony, and

constraints, as a guide[1]. However, the exploratory nature of much of the model construction did not always lend itself to these principles.

Step I of Model Construction

In step one (see figure 1) the central or core endogenous concepts, i.e., the dependent variables were conceptualized in causal model form. This was seen as a critical first stage of development because this segment of the model was integral to all later stages. The inability to successfully model these concepts would make progression difficult. There were four concepts in this first stage of modeling: (overall) research utilization, instrumental utilization, conceptual utilization, and symbolic utilization.[2] Their placement as it is pictured in figure 1 was determined by two factors. First, I believed that overall research utilization was made up of (caused by) instrumental, conceptual and symbolic utilization, and that overall research utilization, if measured repeatedly, would directly influence subsequent measurements of it by increasing in magnitude. Second, it was grounded in the structure of the survey questionnaire which was structured to ask the same question about overall research utilization four times. The location of each of the four questions was deliberately chosen. The first location was as question one of the survey, the second was as question three of the survey, after the respondents had answered question two which deliberately prompted them to consider a series of 14 activities as possible research utilization activities. The third location of the overall research utilization question was as question 13 at the end of section I (page five) of the survey. Section one dealt almost exclusively with the research utilization variables. The final location was as the last question on the last page (p. 24/187) of the survey.

These endogenous concepts were theoretically defined as follows:

Research utilization: a specific kind of knowledge utilization where the knowledge, using Carper's (1978) classification, is primarily empirical in nature, but may also be aesthetic and/or ethical if those forms of knowledge have a research base to substantiate them. It is a complex process in which knowledge, in this case in the form of research, is used by nurses in one or more of the three ways--instrumentally, conceptually, symbolically (or politically).

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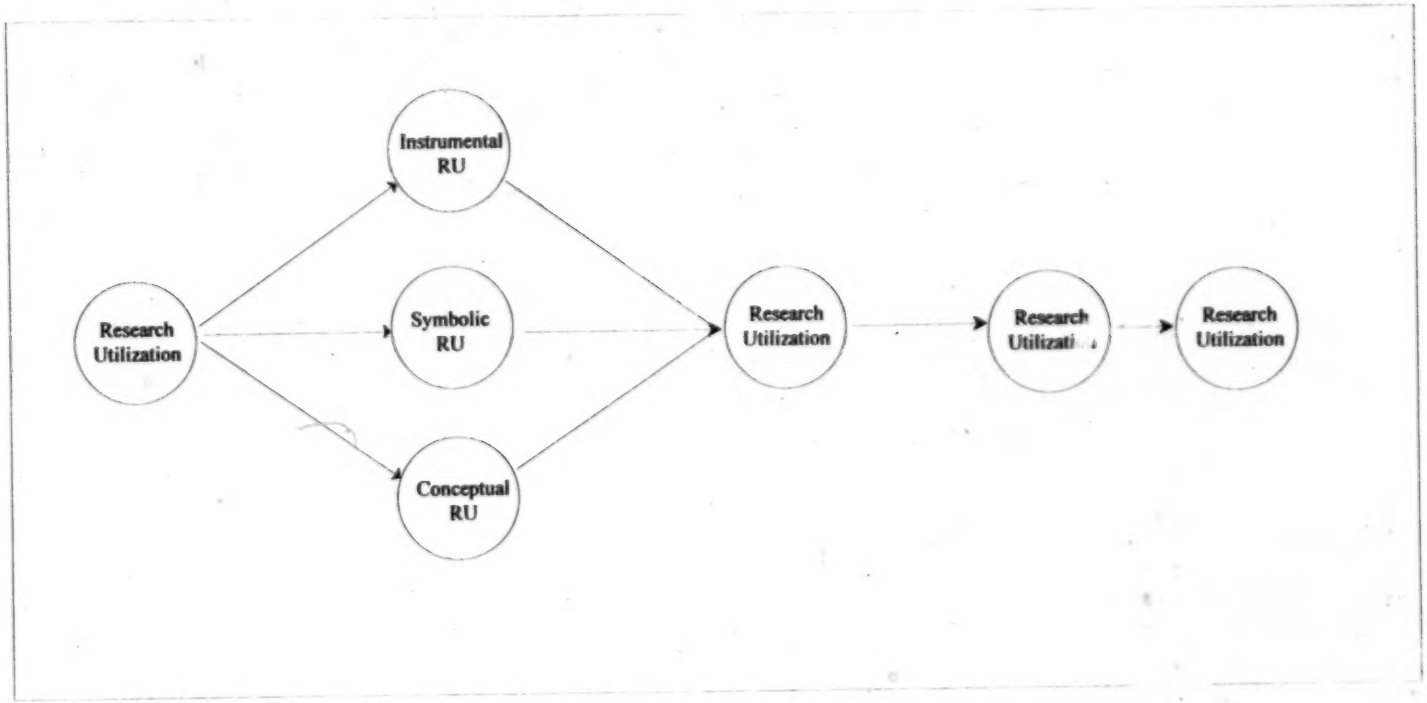
[1]These principles are: (1) *focus*, i.e., model one distinct position and do not try to model the entire set of conceptual structures in the domain of interest, (2) *parsimony*, i.e., have as few estimated coefficients as possible, and (3) *constraints*, i.e., have as many as can be theoretically tolerated, as model implied constraints [places where there are no effects] (Hayduk, 1996).

[2]In the survey questionnaire the terms direct, indirect and persuasive were substituted for instrumental, conceptual, and symbolic respectively, because I believed those terms were simpler, more straight forward to define, and just as descriptive. After working with these simpler terms for several months now I have reverted to their use almost entirely. I believe they are more useful terms for nursing.

Figure 1. Step One of Model Construction.



Instrumental utilization: a concrete application of research where the research is normally translated (on an organizational or nursing unit level) into a material and useable form such as a clinical protocol, a clinical decision algorithm, or the currently popular clinical practice guidelines. At the individual level the research may be applied "directly" as an intervention without translation into another form such as a protocol. It may be applied fully, partially, or in modified form. The research in this case is used to make specific decisions/interventions, i.e., to direct practice in a tangible and measurable way.

Conceptual utilization: the use of research such that the research changes one's thinking but not necessarily one's particular action. In this case, the research informs and enlightens the decision maker (nurse), influencing decisions and interventions in less tangible ways than instrumental utilization.

Symbolic (or political) utilization: the use of research as a persuasive or political tool to legitimate a position or practice. It is commonly used to influence colleagues and decision makers at local, regional, and/or higher levels of authority.

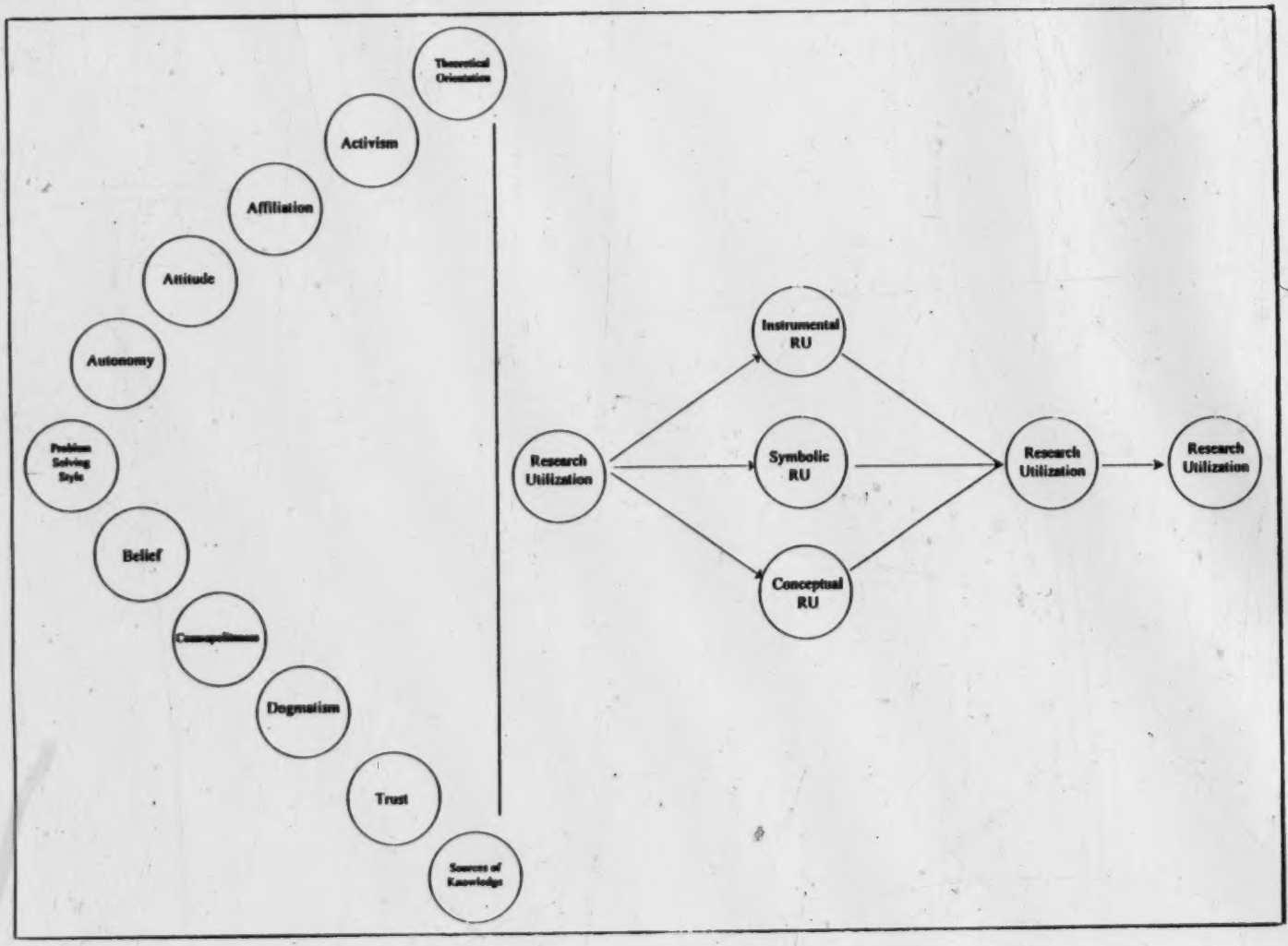
I did not conceptualize research utilization as a dichotomous variable, i.e., either present or not. Rather it is conceptualized along the dimension of magnitude and assumed to be a continuous variable when measured. Larsen (1980) proposed that research utilization can be thought of as being *complete, partial, modified,* or *not at all*. This may be another way of conceptualizing a continuum of use, although I located no studies that examined this approach. If this were the case, complete utilization would probably be the exception, with partial and modified utilization being more common. I believe that modified utilization is likely synonymous with Rice and Rogers' (1980) concept of *reinvention*. While I did not use Larsen's classification in this study, I did include a measure of it in the *Research Utilization Survey* to enable examination of this classification at a later time.

The dependent variables were operationalized using the questions in section one of the survey (see appendix A). The precise questions used to operationalize each of the concepts used in the modeling exercises are identified in chapters five to seven. The research utilization concepts (dependent variables) are discussed in chapter five.

Step II of Model Construction

In step two (see figure 2), the endogenous concepts believed to be important causally to research utilization by nurses were conceptualized in causal model form. At this stage of model development the directions of influence of the concepts were not specified except to assume that they all potentially might directly influence the dependent variables. It was expected that a number of these concepts would be eliminated from the

Figure 2. Step Two of Model Construction.



final model based on the results of the analysis. The concepts that I originally conceptualized as likely endogenous are described in the following sections:[3]

Activism: The nurse's perception of the extent to which her role as a professional or her role as a citizen requires political interaction with others to obtain ideas, support, approval, and resources. I believed that there were both civic and professional aspects to this concept.

Affiliation: The degree to which individuals express primary commitment to one or another organization, in particular, to one of a labour union, the work organization, a clinical speciality, or the professional nursing body.

Attitude: The opinion expressed, along a continuum of negative to positive, by nurses toward research.

Autonomy (professional): The degree to which nurses perceive they have control over their own practice, and have some authority to make practice changes.

Belief: The degree to which research is congruent with the personal beliefs of the nurse. Those beliefs may originate in the family of origin (i.e., the home), in public school, in basic nursing school, in graduate school, or in the work context.[4]

Cosmopoliteness: Cosmopoliteness is the degree to which a nurse is oriented outside the immediate sphere of his or her work duties (i.e., is more than a "nine to fiver"). It is characterized by professional involvement, which is reflected in membership in professional organizations, attendance at professional meetings, professional or nursing union volunteer activity, and routine reading of professional journals.

Dogmatism: The presence of a relatively closed belief system. A nurse possessing this characteristic would be: resistant to change, traditional (i.e., adhering to tradition as authority), a low risk taker, and have low tolerance for uncertainty. Dogmatism was expected to be negatively related to research use, that is, the presence of a relatively open belief system was expected to be associated with higher research use.

Problem solving ability: The ability of an individual to implement behaviours that reflect a goal directed sequence of cognitive operations utilized to cope with challenges or

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[3]A concept is considered endogenous if it is "directly caused or influenced by any of the other concepts [in the model]" (Hayduk, 1987, p. 89).

[4]In chapter nine a more extensive treatment of this concept is discussed, along with a more appropriate label for the concept.

demands.[5]

Sources of knowledge. Sources of knowledge are those places from which the nurse draws data with which to solve clinical problems and make clinical decisions.[6]

Theoretical orientation: A tenet or set of tenets with a nursing origin, that the nurse identifies as being influential in guiding his or her practice. Examples of such tenets in nursing are, adaptation, caring, and self-care.

Trust: The belief that "expert" knowledge (i.e., research produced by nurse scientists) can be believed and trusted, and therefore that, among other things, concern with risks can be properly and reasonably neglected.

These concepts were operationalized using the questions in sections two and three of the survey (see appendix A). The precise questions used to operationalize each of these endogenous concepts in step two are discussed in chapter six.

Step III of Model Construction

In step three (see figure 3) the exogenous or background concepts conceptualized as necessary to complete the model were added. Again, at this stage of model development the directions of influence of the concepts were not specified except to assume that all of these background concepts potentially might influence the endogenous concepts and perhaps some would directly influence the dependent variables. It was expected that a number of these concepts would be eliminated from the final model based on the results of the analysis. The concepts that I originally conceptualized as likely exogenous were: age, sex, education, income, years since last education, clinical speciality, shift usually worked, job satisfaction, marital/partner status, highest level of education achieved, years worked, health and lifestyle activity, number of inservices attended in the last year, number of research and/or statistics courses ever taken, hours currently worked per week, number of weekly dependent care hours (child and adult), satisfaction with shift currently worked, clinical speciality, and shift worked. These variables were operationalized with questions from sections two and three of the *Research Utilization Survey*.[7] The precise

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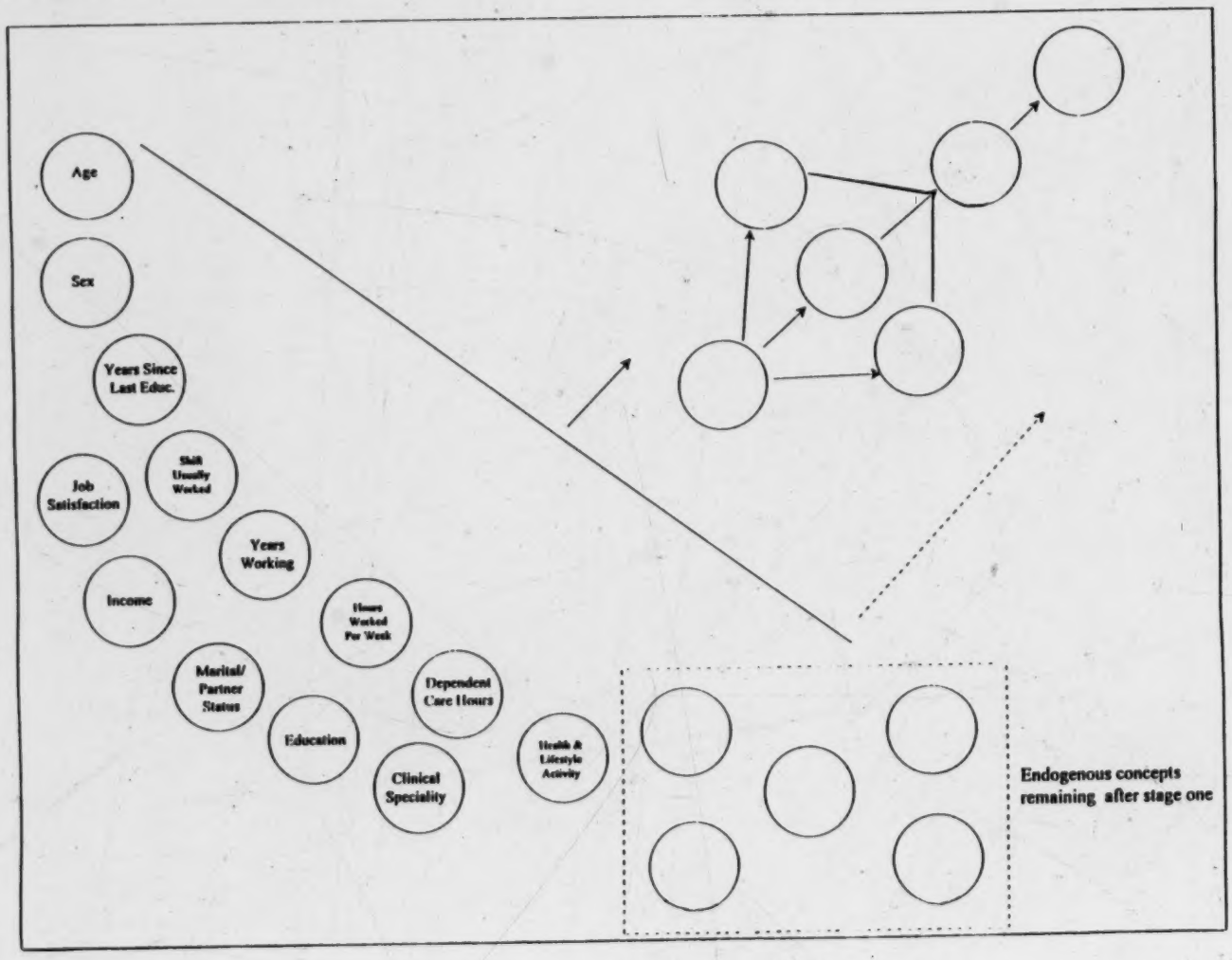
[5]I had originally believed that it would be useful to measure problem solving style (e.g., intuitive vs. cognitive, etc), a concept that the psychologists have had some success in linking to research utilization. However, their conceptualization of style is not congruent with the nature of nursing practice.

[6]Footnote 1 in chapter six addresses my inability to actually include this concept in the modeling.

[7]Since the intent in this study was to over-survey to collect data for later analyses, the survey also contains questions (sections four and five) not relating to concepts discussed in this and subsequent chapters. These questions address attributes of the innovation itself and organizational characteristics.

Figure 3. Step Three of Model Construction.



questions used to operationalize each of the concepts used in step three are discussed in chapter seven.[8] This last model in figure 3 implied to me a rudimentary stage of theory to be tested in this last stage of the study. Later I realized, while it still did imply rudimentary theory, that I would not reach that particular stage in this study and would complete the study settling for a less developed stage of theory.

Alternative or competing models were not proposed at this early stage of the study because of the theoretically underdeveloped state of the field. A limited discussion of competing models is presented in chapter nine within the context of what was determined to be the "core model" in the study. A fuller discussion is not likely to occur until these early theory development stages are more fully exhausted.

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[8]As will be seen in chapter six, two additional concepts, inservices attended and research/statistics courses taken, were added to this last stage of modeling. I had originally speculated that they would be appropriate constituent parts of cosmopoliteness, but later realized that they were not. Sufficient literature support exists in nursing to consider their inclusion as concepts in any modeling exercises.

Chapter 4

Methods and Procedures

Purpose and Objectives

The purpose of this study was to expand existing knowledge of research utilization in nursing by expanding our understanding of the causal mechanisms underlying the utilization and the non-utilization of research by nurses. More specifically, the purpose of this study was to examine the causal relationships between identified individual (personal and professional) variables of practising nurses and the utilization of research by those same practising nurses in Alberta.

The primary objective of the study was:

1. To determine and test the causal structure of a model of research utilization in nursing, in which individual and professional variables influence overall research utilization and the different sub-types of research utilization (instrumental, conceptual and symbolic).

Secondary objectives were:

2. To determine the underlying formal structure of research utilization and its three proposed components--instrumental, conceptual, and symbolic utilization.
3. To determine whether nurses employ some kinds of research utilization more frequently than others.
4. To determine whether it is possible to identify factors influencing non-utilization, as well as, utilization of research.
5. To determine sources of knowledge, other than nursing research, that nurses use in their practice.
6. To collect additional data on organizational and innovation variables for secondary analysis.

Research Design

The study was designed to collect data and use these data to assess a series of structural equation models. Data were obtained using a self-administered survey which

was mailed to 1500 registered nurses in Alberta. Among the advantages to designing a survey to specifically collect data on pre-determined variables, as opposed to conducting secondary analysis are: (1) the ability to try and ensure that indicators (manifest variables) more closely reflect concepts (latent variables) than is often possible with secondary data, (2) acquisition of a Canadian/Albertan data set that will be more meaningful in this country, and (3) the ability to over-survey and collect more data than was necessary for initial modeling exercises--creating a dataset that will be of use for some time to come and which can be used to address many questions without further cost or respondent burden.

Structural Equation Modeling

Structural equation modeling using LISREL was the principle analytic method of the study. Using this approach a series of causal models, linking theoretical concepts to the empirical world, were assessed. LISREL enables the integration of theoretical concepts and observed indicators into a structural equation model (Hayduk, 1987). Once the variances and covariances of the actual data are obtained, these are compared to the variances and covariances *implied* by the model. The fit between the implied covariance matrix (Σ) and the actual covariance matrix (S) provides the essential test of the model. This notion that a model implies a sigma (Σ) is central to using LISREL (Hayduk, 1987, p. 106-117), and to the development of formal structure. Formal structure is taken to mean a structure in which the theoretical concepts are linked clearly to the empirical and measurable world. A series of models was specified in this study. These models were each specified as an "all-eta (η)" model (Hayduk, 1987, chap. 7). This was done in order to achieve more diagnostic information and to permit effects that are not normally permitted in the conventional ksi and eta (ξ and η) nomenclature of LISREL.

Survey (instrument) development

I examined all published questionnaires used by nurse investigators (Alcock et al., 1990; Baessler et al.,1994; Brett, 1986; Champion & Leach, 1989; Funk, et al., 1991a; Lacey, 1994; Pettengill, et al.,1994; Rizzuto et al., 1994; Walczak et al., 1994), and some unpublished questionnaires (Crane, 1989), and determined that none were suitable for this study. The survey questionnaire was initially developed by myself, and then revised based on feedback from the dissertation supervisory committee; Dr. Harvey Krahn, professor and past director of the Population Research Lab (PRL), University of Alberta; the PRL staff; and a small pre-test group. Final revisions were made after a pilot test was conducted in December of 1995. Survey development was done following standard procedures (Dillman, 1978; Fink & Kosecoff, 1985; Fowler, 1993; Rossi, Wright, & Anderson, 1983; Waltz, Strickland, & Lenz, 1991). The final printed questionnaire is a standard format (8½" x 11", saddle stitched) booklet (see Appendix A).

Reliability and Validity

Reliability and validity, which are measurement concerns, can be discussed in two contexts. These are the context of instrumentation and the context of design. In nursing they have been commonly discussed within the context of *instrumentation*. This is usually done by reviewing the appropriate types of each[1] and explaining in detail procedures to try and achieve acceptable measures of each. In this section I will address reliability and validity specific to both, in part because while they may be analytically separable, they are not existentially separable.

Content Validity and Internal Consistency

In a survey questionnaire content validity[2] may be considered the most applicable form of validity with which the investigator is concerned. Content validity is commonly established by either appealing to published evidence, invoking expert authority, or both. In this study little is published in nursing to support or refute the choice of the particular concepts chosen for the proposed study, their conceptualizations, or their measures as they were operationalized. In nursing, research utilization has not been explored using a causal modeling approach or using the conceptualizations of individual concepts and indicators chosen here. Consequently, it was unlikely that obtaining the opinion of a panel of experts would have been a stable indicator of content validity.

The content validity of the survey instrument was instead determined by three approaches. First, good survey question design and careful attention to relevant theoretical concepts in the literature were employed. Each concept was carefully considered and where relevant literature and measures were available they were reviewed. Care was taken to determine if concepts were treated in a manner congruent with the conceptualizations in the study in existing literature. The primary measures used were single questions or series of questions. Where evidence as to the strength and stability of a particular scale was compelling, it was considered for incorporation into the questionnaire, particularly if suitable psychometric characteristics of its items were available. This permitted the investigator to select an abbreviated form of the scale. Scales treated in this way include: the Dempster Professional Behaviors Scale (DPBS) which assesses autonomy, the Heppner Problem Solving Inventory, and Rokeach's

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[1]These have usually included in the case of validity--face, content, criterion related and construct validity; and for reliability--internal consistency, stability, and equivalence. See for example, Burns and Grove (1993); Ferketich (1990); Goodwin and Goodwin (1991); Knapp (1985); Lynn (1986); and Waltz, Strickland and Lenz (1991).

[2]While I am separating content validity from construct validity here for the purpose of discussion, I agree with Burns and Grove (1993) and Goodwin and Goodwin (1991) that construct validity is the appropriate umbrella term, of which all other types of validity are threads.

Dogmatism scale.[3] Other questions used elements of instruments developed to measure attitude,[4] and knowledge sources.[5] Throughout the process respondents' limited tolerance for lengthy questionnaires was a primary consideration in limiting the use of portions of scales.

Second, an early version of the questionnaire was reviewed by two researchers with some expertise in the area.[6] Following their input revisions were made and the questionnaire was pre-tested on a small number of doctoral students (n=3) with strong practice backgrounds to determine completion time, readability, problem areas, and other issues that might arise.

Third, a small pilot was conducted (n=23) on a convenience sample of post-basic baccalaureate and master's level students from the University of Alberta to enable the investigator to be present after questionnaire administration to "debrief" the survey and discuss any questions or problems individuals had in its completion. Data from the pilot were analysed to examine frequencies, relationships, and the variance of variables. As a result of feedback received and of the statistical analysis of this pilot (which were descriptive) final revisions were made resulting in the version found in appendix A. Since this was a self-administered survey, open ended questions were kept to a minimum. Whenever possible, questions were designed to provide responses that could be treated as interval data.

When the data were available for analysis, internal consistency was evaluated on

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[3]Written permission to use the DPBS, descriptive materials, and the original principal components and alpha factor loadings were obtained from Judith Dempster, Associate Professor, College of Nursing, University of Arizona, Tucson, Arizona, 8572. The Heppner scale (Heppner, P. P., 1988). *The Problem Solving Inventory Manual*. Palo Alto, CA: Consulting Psychologists Press, Inc.) was purchased along with the manual and accompanying questionnaires and scoring instructions from Consulting Psychologists Press, Inc, 577 College Avenue, Palo Alto, CA. The Rokeach scale is in the public domain.

[4]Lacey, E.A. (1994). Research utilization in nursing practice--a pilot study. *Journal of Advanced Nursing, 19*, 987-995. Champion, V.L., & Leach, A. (1989). Variables related to research utilization in nursing: An empirical investigation. *Journal of Advanced Nursing, 14*, 705-710. The questionnaires and permission to use them were obtained from Anne Lacey in the United Kingdom, and Dr. Champion at Indiana University, USA.

[5]Baessler, C.A., Blumberg, M., Cunningham, J.S., Curran, J.A., Fennessey, A.G., Jacobs, A.M., McGrath, P., Perrong, M.T., & Wolf, Z.R. (1994). Medical-surgical nurses' utilization of research methods and products. *MEDSURG Nursing, 3*(2), 113-141. The questionnaire and permission to use it were obtained from Dr. Zane R. Wolf.

[6]Dr. Carolyn Pepler, McGill University, Montreal, Quebec; Dr. Judith Floyd, Wayne State University, Detroit, Michigan. Additionally, several individuals with expertise in the field were consulted during the conceptualization of the study (e.g., Dr. J. Horsley, Dr. Cheryl Stetler and Sheila Rodgers of Edinburgh, Scotland).

those scale items discussed above. For the attitude items (Lacey, 1994; Champion & Leach, 1989) the alpha reliability coefficient for the 600 cases comprising the final dataset used in the original analysis was 0.77 for the six items used to form the abbreviated attitude scale. For the autonomy items from the Dempster DPBS scale the alpha reliability coefficient was 0.85 for the ten items used to form the abbreviated autonomy scale. For the problem solving ability items (Heppner, 1988) the alpha reliability coefficient was 0.74 for the ten items used to form the abbreviated scale. Finally, the alpha reliability coefficient for the dogmatism items was 0.72 for the ten items used in the short form of the dogmatism scale (Rokeach, 1956, 1960; Troldahl & Powell, 1965). I considered these acceptable indicators of internal consistency on these scale portions and adequate justification for proceeding with use of the scale score as a single indicator of the concept.[7] No statistical indices other than the content validity index suggested by Lynn (1986) and Waltz, Strickland, and Lenz (1991), and which was not applicable to this study, are available with which to demonstrate that one has sampled the domains of interest specific to content validity. However, I was confident entering the data collection phase of the study, that I had constructed a survey that would yield data on the domains of interest, because of the process by which I had constructed the instrument. Additionally, we were aware that the results of the Lisrel analysis would yield useful information about the construct validity and the measurement structure of both my instrument and my theorizing (modeling).

Construct Validity and Measurement within the Context of SEM

> "LISREL integrates measurement concerns with structural equation modeling by incorporating both latent theoretical concepts and observed or measured indicator variables into a single structural equation model. Furthermore, knowledge of the methodological adequacy of the data gathering process and the quality of particular questionnaire items (measurement instruments) can be directly incorporated into LISREL models by specifying (fixing) a specific proportion of the variance in an indicator to be error variance...thus in LISREL, measurement concerns become integrated with model development, estimation, evaluation, and interpretation..." (Hayduk, 1987, p. 87-88).

In the model developed and tested for this study measurement reliabilities (theta epsilon) were *fixed*. While the literature is generally in accord with fixing lambda coefficients so that the concept and the indicator are measured on the same scale, it has not yet offered a consensus or even a full discussion on fixing theta epsilon and theta delta (Hayduk, 1996). However, by following this procedure the investigator achieves some direct control over the meanings of concepts and the degree of congruence between concepts

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[7]In chapter nine steps to address the issue of scales within the context of single vs. multiple indicators and uni-dimensionality vs. multi-dimensionality are outlined.

and indicators. As is evident from the low (2% or less) error variance that I assigned to most indicators in the various series of models (itemized and discussed in chapters five through eight), I believed that in all instances that the indicators were measuring what I had conceptualized to be the corresponding concepts. In some instances I assigned a larger 5% or 10% error variance based on my understanding of the questions and the respondents' responses to them gained from the construction, and coding of the instrument. Those rationale are presented in the appropriate locations throughout chapters five to eight. While, with single indicators the "best the researcher can do is assert a clear meaning for each concept" (Hayduk, 1996, p. 70) this is not a trivial accomplishment. In the series of models described in the chapters that follow sufficient "model fit" was achieved to convince me that the measurement structure of these models was intact, and that the indicators were reliable measures of corresponding concepts. Later work, discussed in chapter nine will attempt to examine measurement structure more intensively using competing models where multiple indicators are used instead of single indicators.

In the chapters that follow, evidence is presented of construct validity, both of the kind that Cook and Campbell (1979) discuss, that is, design validity and of the kind that Burns and Grove (1993), and Goodwin and Goodwin, (1991) discuss--construct validity related to the instrument. In fact, these two contexts in which construct validity are often considered are not truly separable. If the theory works (i.e., the model fits the data and explains meaningful proportions of variance) then one has achieved some degree of construct validity in the design of a coherent theory. To accomplish that, one has located and measured indicators with sufficient precision to permit the data to reflect that the theory works. In this case, the model that is central to all subsequent modeling exercises, the "core model" achieves acceptable indices of model fit and explains variance in excess of 70% in four of the outcome variables and in excess of 50% in the remaining one. While no one study ever "demonstrates" construct validity, in this study I have made significant progress toward a reconceptualization of research utilization in nursing.

Sampling

Probability sampling was used to obtain a sample from the population of nurses registered in Alberta. The sample was stratified proportionately in an attempt to have the sub-groups, home care nurses, public health nurses, and nurses working in nursing homes, reflect proportions in the population at large.[8] Since nurses cannot practice

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[8]To accomplish the stratification, the "employer type" section of the AARN membership statistics was used to identify groups of more than 1000 nurses. This resulted in the identification of nursing homes (n=2160), home care (n=1113), and community health (n=1200) employers as groups that I would sample proportionately from. Alternatively, clinical area specification could have been used but in conjunction with the statistical assistant at the AARN, I decided it would be more straight forward to use employer

(continued...)

nursing in Alberta without being registered with the Alberta Association of Registered Nurses (AARN) in which membership is mandatory for all nurses who practise in Alberta, it is likely that the entire population of interest in this study was identified. The criterion for inclusion in this sample was: *actively engaged in the delivery of direct nursing care to patients or clients, ie., choice of "staff nurse" on the registration form.* The potential pool of AARN members was 22,484 for the registration year (October 1, 1995 to September 30, 1996).[9] Of these 15,698 (70%) identified themselves as "staff nurses" in either acute care or community settings.

Sample Size

The minimum desired sample size was estimated to be 600. This provided enough cases to successfully split the dataset in half reserving an unused half for an uncompromised assessment of the model. This strategy is recommended (Hayduk, 1987; Tabachnick & Fidell, 1996) when data driven model modifications have been made. It enables the researcher to address whether s/he has capitalized on chance sampling fluctuations in making such modifications. Hoelter recommends that 200 cases provide a "critical n" (in Hayduk, 1987, p. 168). Boomsma (1983) cited in Tabachnick and Fidell (1996) also suggests that a sample size of 200 is adequate for small to medium sized models. Tabachnick and Fidell (1996, p. 640 & 715) suggest as a general rule of thumb that a sample size of 300 is adequate. With a projected maximum 30 variables in any one model at any given stage of modeling, a sample of 300 was judged reasonable (10 cases per variable). This is also consistent with Tabachnick and Fidell's recommendations. Although recent material (Kaplan, 1995; Saris & Satorra, 1993) suggests that power analysis may become routine in the foreseeable future with SEM, there are as yet no readily available procedures with which to calculate sample sizes a priori for each of the infinite styles of SEM's. In particular, estimating power using simultaneous parameter estimation in SEM presents a challenge that is not readily overcome.

Response Rate

Fifteen hundred members (approximately 9.5% of those eligible) were initially surveyed. A response rate of 40.67% (n=610) was achieved. While less than desired, a 40% response rate for a lengthy mailed survey conducted during massive health

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[8](...continued)
type. With this decision made, I calculated the actual numbers that the statistical assistant was to sample randomly from those sub groups. In doing this I made an error that resulted in slight under sampling of the home care nurses, 80 (5.3%) vs. 83 (5.5%), slight over sampling of the public health nurses, 95 (6.3%) vs. 89 (5.9%), and a more pronounced over sampling of the nurses working in nursing homes, 300 (20%) vs. 159 (10.6%).

[9] Source: Membership statistics dated December 21, 1995 received from the registrar, L. Dekker. The total number of AARN members is actually 23,869 but of these 22,484 reside in Alberta.

restructuring and job insecurity is a significant accomplishment.[10] Response rates for surveys of varying descriptions conducted on the AARN's membership have ranged in the vicinity of 30%.[11] Response rates for the survey questionnaires in published nursing studies has ranged from 23% to 87%. Those studies where the sample was larger and random, and where response rate was reported or could be calculated had response rates as follows:

Barta (1995): n=212, response rate (rr) =52% (pediatric educators)
Bostrum & Suter (1993): n=1588, rr=23%
Funk et al. (1991): n=1989, rr=40%
Kirchoff (1982): n=524, rr=87% (coronary care nurses)
Michel & Sneed (1995): n=167, rr=84% (specialized list 49% with master's degrees)
Miller & Messenger (1978): n=499, rr=43%
Rizzuto et al. (1994): n=1217, rr=30%
Varcoe & Hilton (1995): n=183, rr=42%[12]

Characteristics of the Sample

The sample of 610 was reduced to 600 when four cases were eliminated from the study's analysis because respondents' comments on the survey suggested they did not understand or did not adhere to the definitions provided by the investigator on the dependent variables. Six more cases were eliminated because their responses to the question about job title indicated that they were not primarily staff nurses. A comparison of the remaining 600 nurses with the population from which they were drawn is presented in Table 2.[13] Additional biographical information pertaining to the 600 nurses who

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[10]The response rate for the subgroups of interest were as follows: public health nurses, 58.94%, home care nurses, 42.5%, and nurses working in long term care including nursing homes, 37% (despite the inadvertent over sampling of this group, see fn 8). In contrast to the overall response rate of 40.67% these response rates were comparable with the exception of public health nurses who responded with an over 18% greater frequency.

[11]Personal communication Dr. Phyllis Giovannetti and Dr. Janice Lander, University of Alberta.

[12]This is the only other comparable Canadian survey; it was conducted in British Columbia.

[13]The comparison is made based on data the AARN provided in July of 1996 which would have reflected the population of staff nurses at the end of June 1996. This data had to be specifically extracted for the 16,198 nurses who indicated they were staff nurses as of June 30, 1996. The investigator had the statistical profile of the AARN membership when the original sample was drawn in late 1995 but it was not broken down for the then group of 15,886 staff nurses from which the sample was drawn. Data on those specific 15,866 staff nurses could not later be retrieved because of the manner in which the AARN maintains its database of membership information. Additionally, the AARN does not maintain data on all of the background characteristics that were assessed in this study. Staff at the AARN indicated that based

(continued...)

Table 2. Characteristics of the study sample vs. AARN population of staff nurses.

Characteristic	Dimension	Sample (n=600) Dec. 1995	Population (n=16,198) June 1996
Gender	Female	97.5% (n=585)	98% (n=15,886)
	Male	2.5% (n=15)	1.96% (n=312)
Age (years)	Range	21-82	21-82
	Mean	41.7	41.3
	Missing	4.0	8.0
Hours of work/week	0-15 hr/wk	12.5%	16.7%
	16-29 hr/wk	36.7%	36.8%
	30-40 hr/wk	47.4%	41.4%
	42+ hr/wk	3.4%	5.2%
	Mean	28.1	n/a
	Missing		585
Highest Education in Nursing	Diploma	70.8%	79.7%
	Baccalaureate	25.2%	19.8%
	Master's	0.5%	0.4%
	Other	2.7%	negl.
	Missing	0.8%	0.1%
Highest Education Non-Nursing	Diploma	22.3%	n/a
	Baccalaureate	3.8%	5.8%
	Master's	0.5%	0.5%
	Other	4.5%	negl.
	Missing or n/a	68.8%	93.6%
Primary area of responsibility	Gen. Hospital	41.8%	51.9%
	CC/Spec. Hosp	20.8%	19.1%
	Geriatric/LTC	18.3%	12.1%
	Public Health	9.3%	4.8%
	Home Care	5.7%	6.2%
	Other	3.8%	5.8%
	Missing	0.2%	0.1%

[13](...continued)
on their experience the profile had not changed significantly between December 1995 and June 1996, with the exception of an additional 312 members. In the data presented in the "population" column the totals do not consistently sum because in some categories nurses were counted more than once.

comprised the study sample is located in table 3.

Table 3. Additional characteristics of the study sample.

Characteristic	Dimension	Value
Marital Status	Married	79.0%
	Living with partner	2.7%
	Single	8.2%
	Separated/widowed/divorced	8.7%
	Other	1.0%
Income	Less than $10,000	0.7%
	$10000 to $19,999	2.8%
	$20,000 to 29,999	4.8%
	$30,000 to 39,999	10.3%
	$40,000 to 49,999	15.0%
	$50,000 to 59,999	13.0%
	$60,000 to 69,999	10.5%
	$70,000 to 79,999	11.0%
	$80,000 to 89,999	10.2%
	$90,000 to 99,999	8.2%
	$100,000 or more	9.3%
	missing	4.2%
Number of children	Average number of children	1.8
	Mode	2.0
	Range	1-8
	Majority (68%) had, # children	1-3
Shift worked	Days	30.5%
	Evenings	7.5%
	Nights	7.2%
	Rotate shifts	54.3%
	n/a	0.5%
Years since basic nursing education	Average years	18.1
Years since last nursing education	Average years	16.2
Years worked (exclusive of leaves ≥6 months)	Average years	14.9

Data Acquisition

Mailout

The survey was mailed to potential respondents using AARN procedures. The questionnaire was accompanied by an addressed, stamped envelope. Approximately two weeks after the initial mailing of the questionnaire a post card was sent to all non-respondents reminding them of the importance of the study and of a high response rate. About two weeks after this mailing, a letter again emphasising the importance of the study and a high response rate along with another questionnaire and addressed, stamped envelope was mailed to the remaining non-respondents. A final post card was sent about two weeks after the third mailing.[14] Follow-up using registered mail (recommended by Dillman, 1978) was determined to be prohibitively expensive. Follow-up using the telephone was not possible because of AARN policy prohibiting release of member telephone numbers.

Data Management

Since the results of any study are only as valid as the raw data worked with, considerable care was taken to ensure that exhaustive quality control measures were carried out. Additionally, the investigator complied with the recommendations of the University of Alberta's data librarian in carrying out quality control measures and preparing the dataset documentation.

Coding and Entry

The investigator coded all of the questionnaires herself. A random selection of 10% of the questionnaire were re-coded to assess for error rate (a non-systematic error rate of less than 0.1% was determined). Because I found an error (a change in coding decision) part way through the coding, all 610 surveys were recoded on those pages. The professional data entry firm, *Accurate Data* of Edmonton, was engaged to enter the data and to re-enter it for verification. This was completed at the end of June 1996.

Data editing

Once the SPSS command (.sps) file was written, tried and edited, the original raw data file was brought into SPSSWIN 6.1 and a set of frequencies (July 6/96) printed. These frequencies were examined manually, variable by variable and all problems were recorded by hand. The original surveys were then checked against each case and variable identified as requiring investigation. This necessitated checking a majority of the 610

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[14]Samples of the information letters and the postcards are located in Appendix B.

surveys for one reason or another. A further detailed hand record was made of each variable and case requiring adjustment in the raw data file. The raw data file was then edited. Frequencies (July 13/96) were then rerun on this revised raw data file. These frequencies were examined manually variable by variable and all problems recorded by hand. A set of recoding syntax was written with which to systematically examine skip pattern and response set patterns. Each problem encountered in this process was recorded by hand. The raw data file was again edited systematically. First, errors found in the frequency distribution were corrected. Second, errors found as a result of running the skip pattern and response set recoding were corrected. Frequencies (July 22/96) were then rerun on this revised raw data file. A final manual systematic examination was made of each variable, using this July 22/96 frequency run. Remaining corrections were made to the data file and frequencies run on those variables to which adjustments were made (July 27, 1996).

Documentation

Documentation consists of a "documentation manual" which includes a narrative section, the actual codebook, a copy of the original questionnaire, and a "mapped" questionnaire in which each question is assigned its corresponding variable. The narrative includes: background, objectives, survey and study design, data editing procedures, sampling procedures, derived measures, information regarding data transformations, aggregation procedures, the creation of new variables, and decisions made regarding data coding and analysis.

Analysis

Descriptive statistics were used to describe the sample and to identify the univariate characteristics of the indicators. The LISREL analysis was done according to the conventions set out in Hayduk (1987, 1996) and under the advisement of Hayduk. Other approaches to LISREL analysis are available in the literature (e.g., Bollen, 1989); and in nursing examples of other approaches to using LISREL are available (e.g., Bull, Maruyama, & Luo, 1995; Lusk, Ronis, Kerr, & Atwood, 1994). However, the investigator was familiar with and understood Hayduk's approach. The actual mathematical estimates were obtained using maximum likelihood estimation (MLE). The statistical test of the model's fit was χ^2 with a requirement for an accompanying probability on the order of 0.75 to be confident a model was approaching an acceptable fit (Hayduk, 1996, p. 77). An adjusted goodness of fit (AGF) of 0.96 or higher was taken as an indication that a model was approaching an acceptable fit. Many indicators of "fit" are available in the latest LISREL version, however, it is unclear how these indices are determined or what level we should set acceptable thresholds for them. Hayduk has had considerable experience with AGF and as a result recommends at least a 0.96 before the investigator can have confidence that s/he is in the "ballpark". Additionally the residuals, which in SEM are residual covariances, were examined in each model run to determine if

there were systematic patterns of ill fit. Residuals are particularly useful in evaluating model fit because "they perfectly describe the fit between the data and the model" (Hayduk, 1987, p. 170). Examination of residuals is widely recommended (Hayduk, 1987, 1996; Hu & Bentler, 1995; Jöreskog, 1993; Tabachnick & Fidell, 1996).

Covariance matrices were obtained using PRELIS 1.2 (Jöreskog & Sörbom, 1989). Since no weighting was applied to the sample, there were no difficulties in constructing the covariance matrices in this manner. All analyses were done on an IBM compatible desktop computer using SPSS for MS Windows release 6.1. LISREL 7.2 (Jöreskog & Sörbom, 1989), a module of SPSS for MS Windows was used for all modeling exercises.

Ethical Considerations

> The ethics of research is not about etiquette or about protecting hapless subjects at the expense of science, it is about making research "work" for all concerned--creating a mutually respectful, win-win relationship in which valid research is done, subjects are pleased to participate, and the community regards the conclusions as constructive. (Sieber, 1993, p. S9)

The proposed study did not interfere with the three main principles of ethical scientific conduct (beneficence, respect, and justice) common to western society, nor did it pose difficulties with special issues such as research on vulnerable populations. While there were no personal benefits for nurses completing this questionnaire, neither were there any risks. Respondent burden, in this study, took the form of time required to complete the questionnaire.

Confidentiality and Anonymity

No violations of confidentiality are known to the investigator. It is unlikely that confidentiality is at issue in this study as registered nurses responding to the questionnaire were anonymous to the investigator and no method of linking individuals and questionnaires should be possible once the data are in data files. Findings are only reported in aggregate form. However, those questionnaires and the data files will be kept in a secured location for the duration of their retention.

Consent

Consent was presumed when individuals returned completed questionnaires. The information/cover letter sent with the questionnaire explained the study, including anonymity, confidentiality, and reporting of the findings. Additional information (e.g., storage of data, secondary analysis) was included on the first page of the survey instrument. This information letter and follow-up reminders are contained in appendix B

Storage of Data

The original and coded questionnaires will be retained by the investigator for a minimum of seven years in accordance with university policy. The raw data files will be stored indefinitely with a copy retained by the principle investigator. A copy will also be placed in the University of Alberta data library. This copy will be accompanied by a copy of the necessary documentation. This latter copy will be placed there within a time period following data collection that allows for completion of initial analysis and publication of results. This time period is expected to be within two years. This archiving will be done following the procedures of the data library and using an acceptable electronic medium. The intent of placing the data in the public domain is to make data obtained from a random sample of registered nurses (and in part using public funds) available to other legitimate investigators.

Secondary analyses

The investigator intends to do both additional, and secondary analyses of the data. I also intend that other investigators, should they so wish, have access to the data for secondary analyses of their own design. This would include both graduate students and established researchers.

Chapter 5

Modeling the Formal Structure of Research Utilization

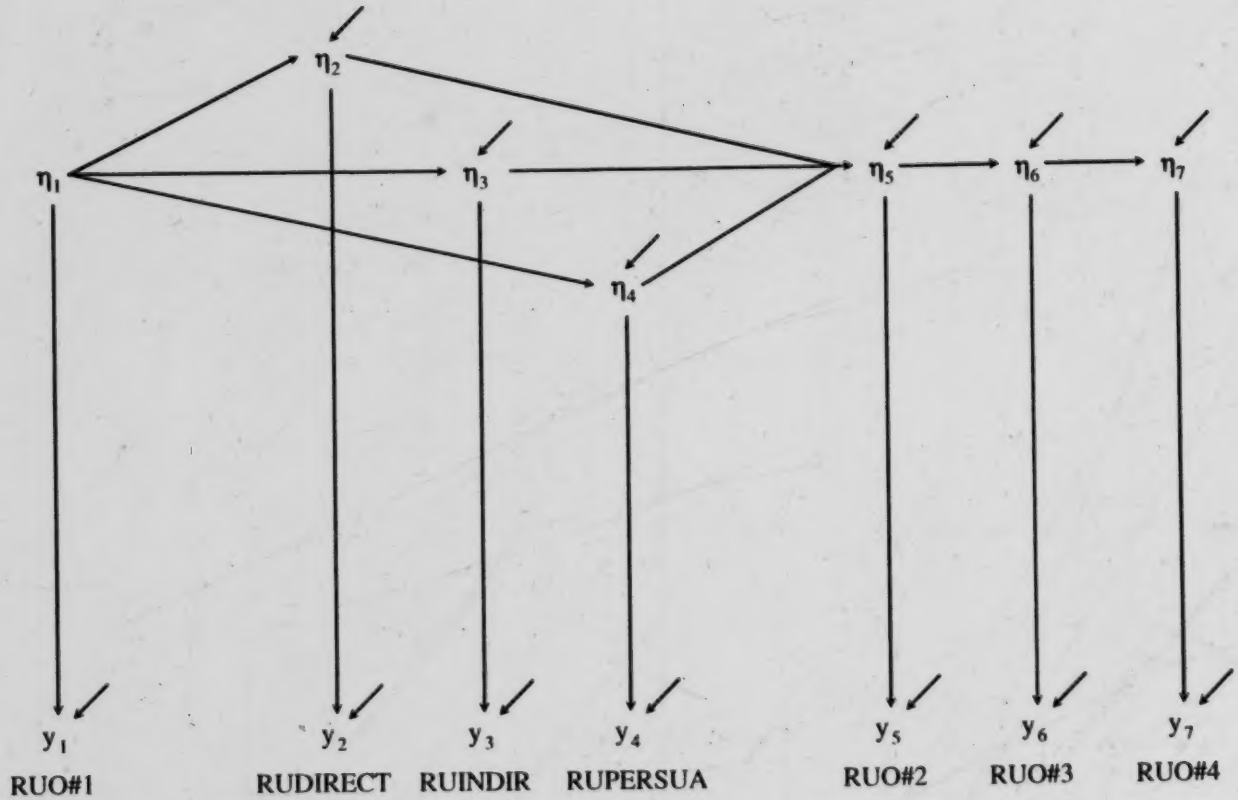
In this chapter phase one of the modeling work is described. The "modeling work" occurred in three definable phases, and in each phase consisted of defining a structural model, obtaining a corresponding covariance matrix, obtaining LISREL estimates, and assessing the validity of any model modifications based on substantive reasoning and on reasoning based on the estimates. In this chapter and those that follow, model 1 corresponds to phase one, model 2 to phase two and model 3 to phase three. In each of chapters five, six and seven, a similar format of presentation is followed: description of the conceptual model, description of the statistical model, discussion of its covariance matrix, presentation of the model's estimates, description of any modifications made, and discussion of the theoretical implications of any modifications.

The Conceptual Model

Model 1 (see figure 4) was originally constructed as nearly a simplex (Hayduk, 1994, 1996) model to represent the formal structure of research utilization. A feature unique to this survey questionnaire is that the same overall research utilization question was asked four times with each question purposively located. The three questions measuring direct, indirect, and persuasive research utilization were purposively placed between the first and second overall research utilization questions, and after a series of fourteen suggestions of items that might comprise overall research utilization. The three kinds of research utilization (direct, indirect, and persuasive) were modeled to imply that the nurses' use of them influenced overall research utilization, that is, overall research utilization is constituted of these three kinds of research utilization. The third overall research utilization question was located at the end of section one (of five sections) of the questionnaire.[1] The fourth overall research utilization question was located at the end of the questionnaire as the final question. Implicit in figure 4 and within the sequence of questioning in the survey questionnaire is a time sequencing. In this all-η model, each of the seven concepts was operationalized with a single indicator. By constructing the

[1]Section one dealt exclusively with the dependent variables: overall research utilization, direct, indirect, and persuasive research utilization. It was characterized by specific definitions and examples for each concept.

Figure 4. The Simplex Model of Research Utilization.



model as a simplex one, I was proposing a particular causal ordering in which η_1 (RUO#1) would demonstrate a stronger effect than η_7 (RUO#7). Or stated another way, I was proposing that there would be causal carry-over with some revision due to the intervening effects of η_2 to η_4 (direct, indirect, and persuasive research utilization) in figure 4. In this model adjacent observations should covary more strongly than observations which are more widely separated from each other. In essence it is saying that the nurses' first assessment of his or her overall research utilization influences his or her second, third and fourth assessments.

The Statistical Model

Each concept in the model had a single indicator. In this section the operationalizing of the conceptual model is presented, that is, each concept and its corresponding indicator is described. Included are: question wordings, examples used to clarify meanings, and coding used.

Overall Research Utilization

Overall research utilization was measured by responses to the question: "Overall, in the past year, how often have you used research in some aspect of your nursing practice?" This question was asked four times throughout the questionnaire.[2] In each case, this question was preceded by the following definition of overall research utilization: "The use of any kind of research findings (nursing and non-nursing), in any aspect of your work as a registered nurse. Do **not** count as research, things you learned in the nursing school where you did your *basic* nursing training." Responses to this question were coded: 1=never, 2=on one or two shifts, 3 (unlabelled), 4 (unlabelled), 5=on about half of the shifts, 6 (unlabelled), 7=nearly every shift, 8=do not know. This particular labelling convention was chosen after pilot testing suggested that concrete labels were required that would made it explicit that the numerical scale was a relative scale. In figure 4 the concept, overall research utilization is labelled RUO#1 the first time it is measured, RUO#2 the second time it is measured, RUO3# the third time, and RUO#4 the fourth time. The indicators for RUO#1 through RUO#4 are labelled respectively, y_1, y_5, y_6, and y_7.

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[2]The fourth and last time the question was asked in the questionnaire, the wording was slightly different in that the phrase "on all the occasions that you could have" was inadvertently appended. It is unknown what percentage of respondents may have noticed this wording alteration (only one respondent made comment on it), and having noticed altered their answer accordingly. I suspect that few noticed given the length of the questionnaire and the late placement of this last question. However, to accommodate any response variation as a result of the wording change a 5% error variance was assigned to this indicator (y_7 in figure 4).

Direct Research Utilization

Direct Research Utilization (RUDIRECT) was measured by responses to the question: "Overall, in the past year, how often have you used *research findings in this **direct** way* in some aspect of your nursing practice?" This question was preceded by the following definition of direct research utilization: "The use of any kind of research findings (nursing and non-nursing) where you **directly use the findings** in giving patient care and/or client interventions. Do not count as research, things you learned in your *basic* training." Four examples of direct research utilization immediately followed the definition.[3] Responses were coded exactly the same as for overall research utilization. The indicator, in figure 4, for the concept RUDIRECT is y_2.

Indirect Research Utilization

Indirect Research Utilization (RUINDIR) was measured by responses to the question: "Overall, in the past year, how often have you used *research findings in this **non-direct** way* in some aspect of your nursing practice?" This question was preceded by the following definition of indirect research utilization: "The use of any kind of research findings (nursing and non-nursing) to **change your thinking or your opinions** about how to approach certain patient care or client situations. Do not count as research, things you learned in your *basic* training." Four examples of indirect research utilization immediately followed the definition.[4] Responses were coded exactly the same as for

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[3]These examples were:

Internally rotating the femur during injection into the dorsogluteal site, in either the prone or side-lying position to reduce discomfort.

Limiting suctioning (and other interventions known to increase intracranial pressure [ICP]) in ventilated patients with known or suspected high ICP.

Working with pregnant women to help them quit smoking (because of the adverse effect of smoking during pregnancy on birth weight)

Following current CDC immunization guidelines in well baby clinics.

[4]These examples were:

Because you are aware of the stages of death and dying, you understand a newly diagnosed cancer patient's refusal to believe the diagnosis.

Whenever possible, you schedule night routines due to an awareness of the normal sleep cycle (e.g., 90 minutes), so as not to interfere with patients' sleep and rest.

(continued...)

overall research utilization. The indicator, in figure 4, for the concept RUINDIR is y_3.

Persuasive Research Utilization

Persuasive Research Utilization (RUPERSUA) was measured by responses to the question: "Overall, in the past year, how often have you used *research findings in this **persuasive** way*?" This question was preceded by the following definition of persuasive research utilization: "The use of research findings (nursing and non-nursing) to **persuade others, who are usually in decision making positions, to make changes** in conditions, policies, or practices relevant to nurses, patients/clients, and/or the health of individuals or groups. Do not count as research, things you learned in your *basic* training." Three examples of persuasive research utilization immediately followed the definition.[5] Responses were coded exactly the same as for overall research utilization. The indicator, in figure 4, for the concept RUPERSUA is y_4.

Scaling and Reliability in LISREL

Scale equivalence was ensured by fixing the lambda (λ) value to 1.0 for each concept. That is, the structural coefficients between each concept and its corresponding indicator were fixed at 1.0 ensuring that each concept was measured on the same measurement scale as its indicator. Measurement reliabilities were all fixed rather than

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[4](...continued)
Knowing that smoking during pregnancy can result in low birth weight babies, you anticipate lower birth weight and other related problems in babies of smoking mothers.

Based on the knowledge that pregnancy is sometimes a trigger for domestic violence you raise your index of suspicion during prenatal visits.

[5]These examples were:

Because you know that people in lower income groups have a higher incidence of chronic and communicable disease, and domestic violence, you and/or your unit prepare a special report to your regional health authority when social assistance is cut to single mothers in your area.

You use your knowledge of the adverse effects of irregular shift rotations on employee performance and health to persuade your supervisors to improve the shift rotation in your unit.

You use your knowledge of recent research which demonstrates that male infants experience significant pain during circumcision to persuade a physician you work with to use a local anaesthetic during the procedure.

permitted to be free (i.e., the error variance was fixed). By fixing these theta epsilon (Θ) variances, the proportion of variance in each indicator thought to arise from sources other than the concept is identified. This strategy allows the researchers some direct control over the meanings of the concepts (Hayduk, 1987, p. 118-123). The diagonal elements of the Θ matrix were each assigned 1% error variance for RUO#1, RUDIRECT, RUINDIR, RUPERSUA, RUO#2, and RUO#3 (y_{1-6}). Such an assignment asserts that these indicators are closely connected to the concepts, that is, they are good and reliable measures of the concepts. This low error variance was selected because of the considerable care taken in constructing the questions, the explicit definitions and examples accompanying each question, and because the questionnaires of any respondents who indicated they did not adhere to the definitions or were not in a direct care delivery position, were eliminated from the sample. An error variance of 5% was assigned RUO#4 (y_7) because of the wording variation noted in footnote 2. Since only one in 600 respondents indicated noticing the variation, because of the placement of this question at the end of a lengthy questionnaire and because it was very close to the earlier questions in wording, it was not thought that much measurement error was introduced by the wording discrepancy. However, the 5% was assigned to account for that which may have been.

Univariate Summary Statistics for the Indicators

The statistics describing the seven indicators in model 1 are presented in Table 4. These statistics are based on the respondents in the first randomly split half of the data (rusplit1). As described in chapter 4, the data were randomly divided in half at the outset of modeling in order to reserve an unused data set for an uncompromised assessment of the final models. The first half (rusplit1) was used in all of the model constructing and assessment exercises and the second half (rusplit2) was used for this appraisal of the degree to which I had or had not capitalized on chance.

The Covariance Matrix

The covariance matrix for Model 1 was created using pairwise deletion of missing cases. This resulted in an effective sample size ranging from 264 to 290 out of a total sample size of 300. The average sample size (271) was used to run the LISREL program. Missing values for the pairs of variables in the matrix ranged from 3.33% to 16.67%. Hayduk (1987, 1996) now recommends the use of a pairwise deletion procedure as the preferred method when obtaining the covariance matrix. The actual matrix is located in Appendix C.

Table 4. Statistics for the Indicators in Model 1: The Formal Structure of Research Utilization

Indicator	Range	Mean	Std Dev	Skewness	Kurtosis
RUO#1 (y_1)	1-7	4.163	1.917	0.017	-1.168
RUDIRECT (y_2)	1-7	4.360	1.902	-.021	-1.182
RUINDIR (y_3)	1-7	5.203	1.824	-.773	-.499
RUPERSUA (y_4)	1-7	3.603	1.763	.368	-.964
RUO#2 (y_5)	1-7	4.657	1.841	-.201	-1.103
RUO#3 (y_6)	1-7	4.705	1.762	-.210	-1.086
RUO#4 (y_7)	1-7	4.628	1.773	-.246	-1.052

Model Estimates, Model Fit and Model Modifications

The Simplex Model

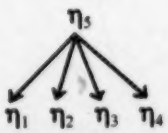
Estimates of the model in figure 4 were obtained using maximum likelihood estimation (MLE) and model fit was assessed by examining χ^2, the adjusted goodness of fit (AGF) index, the size of the standardized residuals, and other parameters. Estimation of the model in figure 4 resulted in: χ^2=260.05, *df* 13, p=.000 and AGF=.556. These indices in conjunction with a significant pattern of standardized residuals in excess of an absolute value of two (ranging from -10.757 to 9.24) suggested an ill fitting model. Close examination of the residual pattern in conjunction with the modification indices led to the conclusion that freeing BE(5,1), permitting an effect from η_1 to η_5 (RUO#1 to RUO#2) might be sufficient to salvage the model. The criteria of fit when this model was run were: χ^2=172.39, *df* 12, p=.000 and AGF=.660. Examination of the standardized residuals still revealed many residuals larger than an absolute value of two and a persistent "overfit" going from η_1 to $\eta_{2\text{-}5}$ and a persistent "underfit" elsewhere. Examination of the modification indices did not suggest any further theoretically logical modifications. Before concluding that the simplex model was not salvageable, I made one additional change in the model. This was done to determine whether the model was failing because of the inclusion of the three kinds of research utilization, direct (η_2), indirect (η_3) and persuasive(η_4), or because of the fundamental failure of the simplex model. The three kinds of research utilization were eliminated from the model and the simplest form of the simplex model ($\eta_1 \rightarrow \eta_5 \rightarrow \eta_6 \rightarrow \eta_7$) was assessed. Running this model resulted in: χ^2=47.39, *df* 3, p=.000 and AGF=.760. The standardized residuals revealed all residuals in excess of an absolute value of two and suggested no hope of redeeming

the simplex model.

Considering that I had deliberately asked a series of time sequenced questions in a questionnaire structured to favour the simplex model, and assuming confidence in the measures, it was striking, if not astonishing, to find that the data did not fit the simplex style of model. Its failure coupled with any inability to locate an alternative style of model would make for a short thesis and little progress on the formal structure of research utilization. I was being challenged *by the data*, not by any theory, to locate an alternative model. This process is described below.

The Factor Model

There are two basic styles of model that would potentially explain research utilization, the simplex one, and the factor model. In this case I had first attempted a simplex model. Hayduk pointed out (August 12, 1996), however, that the correlation matrices for these data demonstrated an "equivalence" of correlations, and not the declining pattern that one would expect with the simplex model. This provided support for discarding the simplex style of model and attempting to remodel these concepts with a factor or "common cause" style of model. This carried with it a significant theoretical implication. In a factor model the four overall research utilization concepts (RUO#1 to RUO#4) would be conceptualized as arising from a common and unmeasured cause--*real* research utilization. This model was constructed in two steps, the first of which looked schematically like:



where η_5 was the unmeasured concept *real research utilization*. This conceptual model was constructed and the statistical model specified such that, scaling and reliability specification was done exactly as it had been in the simplex model. First, the structural coefficients between each concept and its corresponding indicator (λ) were fixed at 1.0 ensuring that each concept was measured on the same measurement scale as its indictor. Second, measurement reliabilities were all fixed rather than permitted to be free. The diagonal elements of the theta epsilon (Θ) matrix were each assigned 1% error variance except RUO#4 (now η_4) where it was specified as 5%. The psi (ψ) variance of *real research utilization* (η_5) was fixed at 1[6] and the remaining ψ variances of the concepts

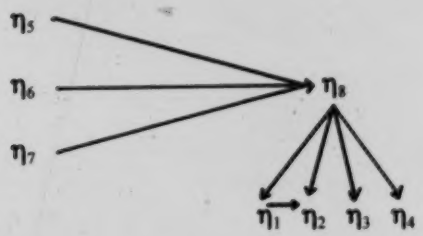
[6]To enable the model to run with a phantom concept that had no observed indicator, it was necessary to insert start values because the LISREL assumption for the starting algorithm was not met. The variances of the diagonal elements of the ψ matrix were assigned start values equal to 1.5, and the

(continued...)

were freed. The model was estimated using MLE and the resulting criteria of fit were: χ^2=50.44, *df* 2, p=.000 and AGF=.536. The standardized residuals were 7.424 for BE(2,1) and BE(4,3) and in all cases greater than an absolute value of two. The modification indices were largest for BE(2,1) and (4,3).

Careful reflection on the implication of freeing either of these coefficients led the investigator to conclude that freeing BE(4,3) was theoretically illogical. However, freeing BE(2,1), the effect going from RUO#1 to RUO#2 was theoretically plausible, especially given the investigator's in depth understanding of how the measurement (survey questionnaire) was constructed. To free this coefficient would imply that there was "carry over"from the first to the second measure of overall research utilization, a modeling element reminiscent of the original simplex model, and with which I was comfortable on a limited basis. The first measure of overall research utilization, RUO#1, was the first question on the questionnaire. Between it and the second measure (RUO#2) were a series of questions asking the respondents if they agree or not with the inclusion of a list of items as research utilization activities (in effect, a deliberate coaching to further "force" the investigator's intended meaning of research utilization), and a series of questions about direct, indirect, and persuasive research utilization. Given this degree of prompting between RUO#1 and RUO#2, which did not occur between any of the other overall research utilization questions, it was reasonable to expect a "carry over" of instructions that influenced the answers to RUO#2. That is, the response to RUO#1 influenced the responses to RUO#2 given the unique characteristics of the questionnaire and its particular time ordering. Therefore, BE(2,1) was freed and the model re-run resulting in the following: χ^2=.16, *df* 1, p=.688 and AGF=.997. The standardized residuals revealed no values greater than an absolute value of 0.5 and accordingly no modification indices of any significance. I concluded that this model "fit" the data.

In step 2 of constructing the factor model, the three kinds of research utilization, direct, indirect, and persuasive (η_5, η_6, η_7, respectively) were added. This took the schematic form, where real research utilization is now η_8:



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[6](...continued)
freed coefficients in the β matrix were assigned start values of 1.25. Additionally, the no start value (NS) command was inserted on the final syntax line.

The above sketch represents a fundamental shift from the simplex model. In the simplex model, what are now η_5, η_6, and η_7 were located between what are now η_1 and η_2. In this model they cause η_8 (real research utilization).

The specifications in step 1 remained the same, and the specifications for the three additions (η_5, η_6, η_7) remained the same, with λ=1.0, and Θ error variances specified as being 1%; the ψ variance of *real research utilization* (η_8 in this version of the model) remained fixed at 1. Running this model resulted in χ^2=29.19, *df* 10, p=.001 and AGF=.913. The largest standardized residual was 5.030 for BE(5,2). There were also standardized residuals larger than an absolute value of 2 for BE(3,2), (4,3) and (5,4). The modification indices suggested a number of changes but only freeing BE(2,5) where there was a predicted change of 0.470 units in η_2 for each unit change in η_5 was considered theoretically consistent. The logic underlying this theoretical consistency follows that of the logic for why it was reasonable to expect a "carry over" from RUO#1 to RUO#2. That is, the response to RUO#1 influenced the responses to RUO#2 given the unique characteristics of the questionnaire and its particular time ordering.

This model freeing BE(2,5) was run and resulted in: χ^2=10.32, *df* 9, p=.325 and AGF=.966. Examination of the residuals showed six residuals with a value of greater than an absolute value of 2. The modification indices suggested few changes of significance; of these freeing BE(1,5) was the most theoretically consistent.[7] Such an action was predicted to result in a modest change in η_2 of 0.211. This coefficient was freed resulting in: χ^2=4.62, *df* 8, p=.797 and AGF=.983. No other diagnostic data suggested any additional changes would be productive. This model was judged to have good fit. As would be expected, with the freeing of the two coefficients BE(1,5) and (2,5) some lessening of the strength of the effect from η_8 to both η_1 and η_2 occurred (η_1: 0.699 to 0.599; η_2: 0.448 to 0.203). All effects stayed significant, with the t-values for the beta coefficients in this final model being:

BE(2,1)	BE(1,5)	BE(2,5)	BE(1,8)	BE(2,8)
7.863	2.489	4.965	6.918	2.745
BE(3,8)	BE(4,8)	BE(8,5)	BE(8,6)	BE(8,7)
14.274	14.069	9.734	5.493	3.105

The explained variances for each of the concepts in this final model in phase one

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[7]Direct research utilization (η_5) has been the kind of research utilization most often referred to in literature and in discussions that occur within nursing and within health care agencies. Hence, it is likely that it is the kind of research utilization most closely identified with by practising nurses and would exert a stronger influence on measures of real research utilization, than would other kinds of research utilization in a questionnaire such as this.

were[8]:

RUO#1 (η_1)	RUO#2 (η_2)	RUO#3 (η_3)	RUO#4 (η_4)	DIRECT (η_5)	INDIR (η_6)	PERSUA (η_7)	REALRU (η_8)
.533	.707	.831	.791	.000	.000	.000	.711

The fact that these explained variances were so high (all but one in excess of 70%) was reassuring, indicating to me that this core model had good construct validity. This final model depicted in figure 5 forms the core of the models constructed and assessed in phases two and three. It is referred to during the reminder of the chapters as *Model 1* or the "core model".

Summary

The reader will recall that the simplex style of model was abandoned in favour of the factor ("common cause") style of model. The final version of the factor model demonstrating good fit, was arrived at after three modifications. RUO#1 was permitted to influence RUO#2, and an effect was permitted from RUDIRECT (direct research utilization) to both RUO#1 and RUO#2. Although these last two modifications lessened the strength of the effects from *real* research utilization (η_8) to RUO#1 and RUO#2, they did not alter the fundamental structure or assertions of the causal model. Nor is the factor like model of research utilization arrived at theoretically inconsistent with the investigator's original position. What is different is that instead of a model which predicted that the nurses' responses to the first question on overall research utilization would influence responses on the second, the second would influence the third and the third the fourth, I arrived at a model which asserts that there is an underlying concept--real research utilization--which caused the nurses to respond to the four questions on overall research utilization in a particular way. The three kinds of research utilization (direct, indirect, and persuasive) remain in the model as causes of overall research utilization, in this case directly affecting the true underlying concept (real research utilization), as well as directly affecting RUO#1 and RUO#2, and indirectly affecting RUO#3 and RUO#4. The theoretical implications of living with a factor instead of a simplex model are important. This factor or "common cause" model asserts that: (1) there is an actual real condition--real research utilization--that exists, (2) it is influenced by unique "sub" kinds of research utilization (direct, indirect, persuasive), (3) nurses can reasonably report this real research utilization, and (4) we can measure it. Further, it may be possible to measure both real research utilization and the other kinds of research utilization, with single "proxy like" questions, thus avoiding complex and detailed measures that have been employed in the past to determine extent of research utilization.

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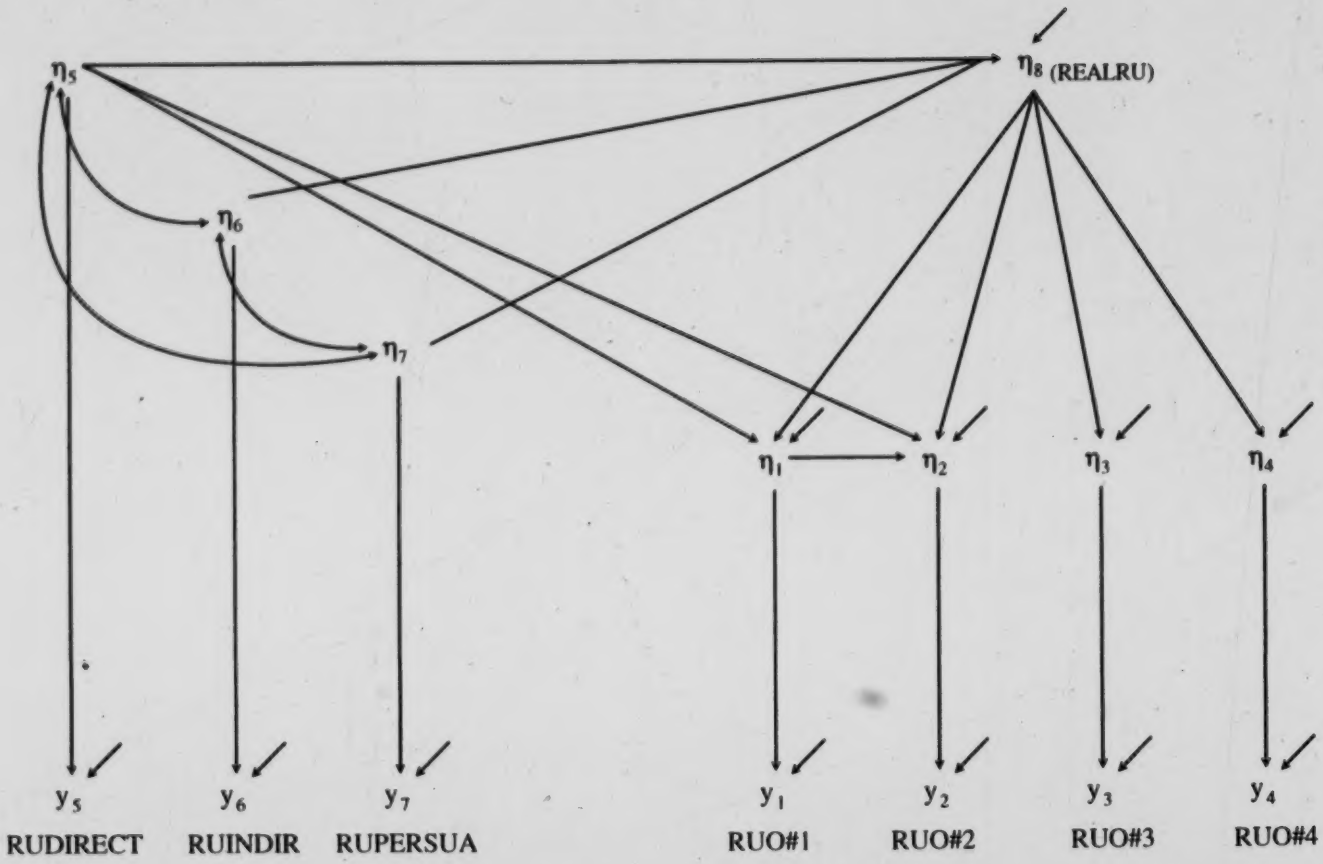
[8]The actual variance in REALRU, an unmeasured concept, was 3.457; the psi (ψ) variance was set at 1 for REALRU in all of the models. Since R^2=1-[Var (ψ)÷Var (η)], the derivation of the reported explained variance of .711 is apparent, i.e., R^2=1-(1÷3.457)=.7107=.711.

Figure 5. Final Model 1: The Formal Structure of Research Utilization.



Chapter 6

The Causal Role of Individual Factors

In this chapter phase two of the modeling work is presented. In phase two individual factors, both personal and professional, were added to the functioning model 1 (figure 5) described in the previous chapter. This work resulted in a final acceptably fitting model 2 with which the third phase work was begun.

The Conceptual Model

Model 2 (see figure 6) was originally conceptualized with eleven concepts influencing research utilization (see figure 2, page 43). The results of phase one resulted in a different causal structure in the model depicting the formal structure of research utilization (the "core model") than had been anticipated. This in turn influenced the addition of the individual factors to the model; and the following plan was formulated with which to conduct this phase. First, working again with an all η model, the ten[1] individual concepts would be added to the core model as η_8 to η_{20},[2] permitting all covariances among η_5 to η_{20}, but no additional effects (beyond what were permitted in model 1 to η_1 to η_4 or to η_{21}[3]. This approach was chosen first because it required the minimum number of parameter estimations. In an admittedly data driven series of exercises, the fewer parameter estimations required the fewer demands placed on the data. Second, using the diagnostic information from this run, additional effects that were statistically indicated and conceptually sound would be specified and assessed. As will

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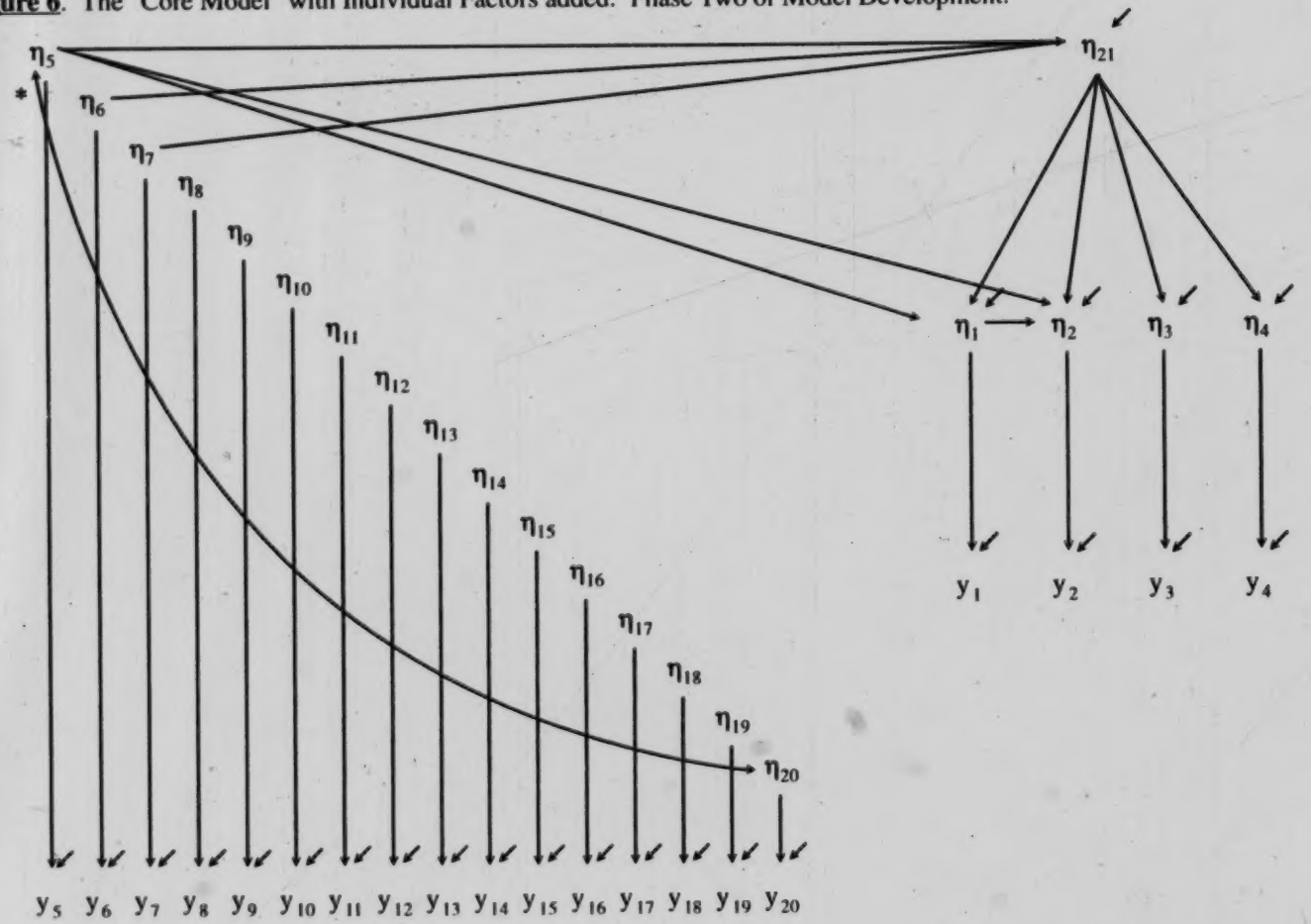
[1]Ten concepts were utilized, not eleven because it was not possible to enter the "sources of knowledge" concept, given the decisions I had taken to use a modification of the Baessler et al. (1994) series of questions to measure knowledge sources and the form those responses then took. While I could have simply added the scores on each of the 16 questions in this section, arriving at a total "score" that could have been entered into the structural equations, that total score would have been conceptually meaningless. Alternatively, I decided to drop the concept for the purposes of the causal modeling, assigning it to the series of secondary analyses planned upon completion of this study.

[2]In figure 6, the four concepts η_{10} to η_{13} represent the concept affiliation after it was recoded to enable its entry into the modeling. Figure 6 therefore looks as if 13 concepts are represented by η_8 to η_{20}, but in fact only 10 concepts are represented.

[3]The phantom concept (real research utilization) was held as the last numbered η in all of the modeling exercises. Thus, what was η_8 in the first model, is now η_{21} in model 2.

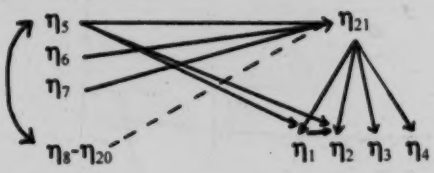
Figure 6. The "Core Model" with Individual Factors added: Phase Two of Model Development.



*all possible covariances permitted

be seen, this plan had to be modified but did eventually result in a working model 2.[4]

This model development plan can be sketched as:



The Statistical Model

Each concept in this model had a single indicator. In this section the operationalizing of the conceptual model is presented, that is, each concept and its corresponding indicator is described. Included are: question wordings, examples used to clarify meanings, and coding used. The measures of the concepts entered in this phase were all single indicators. Where evidence of the strength and stability of a particular scale was compelling, that scale's score was used. However, rather than incorporate the entire scale, an abbreviated form of these scales was used to keep the survey questionnaire as short as possible. Scales treated in this way were: the Dempster Professional Behaviors Scale (DPBS) which assesses autonomy, the Heppner Problem Solving Inventory, and Rokeach's Dogmatism scale.[5] Other questions used elements of instruments developed to measure attitude (Champion and Leach, 1989; Lacey, 1994).[6] Where available psychometric information on the scales was used to assist in the selection of items for inclusion.

Theoretical Orientation (η_8)

Theoretical orientation was measured by responses to the question: "To what extent is your nursing practice guided by a theoretical position? (Examples of theoretical

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[4]Although the plan required some modification I stayed as close as possible to the original plan.

[5]Written permission to use the DPBS, descriptive materials, and the original principal components and alpha factor loadings were obtained from Judith Dempster, Associate Professor, College of Nursing, University of Arizona, Tucson, Arizona, 8572. The Heppner scale (Heppner, P. P. (1988). *The Problem Solving Inventory Manual*. Palo Alto, CA: Consulting Psychologists Press, Inc.) was purchased along with the manual and accompanying questionnaires and scoring instructions from Consulting Psychologists Press, Inc, 577 College Avenue, Palo Alto, CA. The Rokeach scale is in the public domain.

[6]Lacey, E.A. (1994). Research utilization in nursing practice--a pilot study. *Journal of Advanced Nursing, 19*, 987-995. Champion, V.L., & Leach, A. (1989). Variables related to research utilization in nursing: An empirical investigation. *Journal of Advanced Nursing, 14*, 705-710. The questionnaires and permission to use them were obtained from Anne Lacey in the United Kingdom, and Dr. Champion at Indiana University, USA.

positions include: hierarchy of needs, systems theory, self-care, body systems, adaptation, goal attainment, human becoming, general needs, person-environment interaction, etc.)" Responses were coded on a scale from 0 to 5, where 0=not at all, and 5=a great deal. The indicator in figure 6 for theoretical orientation (THORIENT) is y_8.

Activism (η_9)

Activism (ACTIVISM), the amount of civic and political activity (related to being both a professional and a citizen) the nurse engages in, was formed by summing the scores on two sets of questions. The first, the following four questions, were each measured on a scale from 0 to 4, where 0=never and 4=always: "Do you vote in the following? a. Federal Elections, b. Provincial Elections, c. Municipal Elections, d. AARN/UNA/SNA Elections". The second set, the following five questions, were each measured on a scale from 0 to 4, where 0=never, 1=once, 2=twice, 3=three times, 4=four or more times: "In the past year, how often have you.... a. Organized a petition, b. Signed a petition, c. Marched in protest of something, d. Written a letter to a politician, e. Written a letter to an editor." The possible range of scores was 0 to 30, with higher scores reflecting more activism. The indicator in figure 6 for ACTIVISM is y_9.

Affiliation (η_{10}-η_{13})

Affiliation (AFFIL) was measured by the responses to the question: "Which of the following associations, organizations or groups do you identify most closely with as a nurse? Circle only one: The organization in which you work, Your union, A Clinical Interest or Speciality group, AARN and/or CNA, other (Specify)." AFFIL was recoded into a series of five dummy variables (1=yes and 0=no): AFFILC, η_{10} (affiliation to the clinical group or speciality); AFFILO, η_{11} (affiliation to some other entity); AFFILP, η_{12} (affiliation to the profession); AFFILU, η_{13} (affiliation to a union). AFFILW (affiliation to the work place or organization one works in) received the most responses and was excluded from the prediction, although remaining in the model as the reference group. This recoding was done to permit entry of the affiliation variable into the SEM's. The indicators in figure 6 for these four dummy variables are y_{10} to y_{13} respectively.

Attitude (η_{14})[7]

Lacey's modification of the questionnaire used by Champion and Leach was used to select the six attitude items that formed the abbreviated attitude scale. Items with both positive and negative statements were included. The six items were selected based on

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[7]Missing values were only adjusted for in three cases: the attitude scale, the dogmatism scale, and the problem solving ability (PSA) scale. They were dealt with by substituting the mean value on that scale for the missing value. For the attitude scale, there were four cases with one missing value each, for the PSA scale there were three cases with one missing value each, and for the dogmatism scale there were six missing cases with one missing value each. Remaining missing values throughout the questionnaire were treated as such and lost from the analysis.

their congruence with the investigator's conceptualization of attitude to research. The items from Lacey's questionnaire were: 1, 7, 12, 18, 19, and 33. Items 12, 18 and 33 require reversal of their coding (they are negative items). Respondents were asked to circle "the one number that best describes your beliefs about research" The items were:

a. Research is needed to improve nursing practice continually
b. Research findings are too complex to use in practice
c. I would change my practice as a result of research findings
d. Research is not applicable to my practice
e. Research helps to build a scientific base for nursing
f. It takes too much effort to apply research to practice

Responses were coded as: 1=strongly disagree, 2=disagree, 3=uncertain, 4=agree, 5=agree strongly. Responses on to the six items were summed to create one value for the scale. The alpha reliability coefficient for the 600 cases comprising the final dataset used in the original analysis was 0.77 for the six items used to form the abbreviated attitude scale. The indicator in figure 6 for ATTITUDE is y_{14}.

Autonomy (η_{15})

Ten items from the 30 item Dempster Practice Behaviors Scale (DPBS) were selected for inclusion in the survey questionnaire. The DPBS was constructed to measure the extent of autonomous behaviours in practice. Dempster, in the material that accompanies the scale when it is requested, describes the scale as empirically unidimensional and theoretically multi-dimensional. The four theoretically based sub-scales in the DPBS are: (1) readiness, (2) empowerment, (3) actualization, and (4) valuation. The 10 items were chosen using the principle components factor analysis item loadings and the alpha loadings.[8] The items are:

Factor 1: items 2, 6, 20, 22, 29
Factor 2: items 1, 3, 14, 25, 30

The alpha loadings were examined first because Dempster indicates the scale is empirically unidimensional. This resulted in four items from factor 1, two from factor 2, and two from factor 4 using loadings of 0.7 or higher. The factor 4 items were deleted; I assessed them as the weakest items on the scale specific to autonomy, seemingly more related to self-esteem which may be a part of personal autonomy. However, in this study my interest was in professional autonomy. Factor 3 items were not used because they seemed rooted in power, control and legal status which may not apply to Canadian nurses given the different health systems (and pilot subjects had had some difficulties with factor

[8]This psychometric information was obtained by requesting it directly from Dempster who forwarded original dissertation excerpts.

three items, especially those relating to the legal system).

Four factor 1 items (2, 6, 20, 29) and two factor 2 items (14, 25) remained. I decided to take 5 items from each factor because the items in these two categories were closest to the conceptualization of autonomy. Item 22 was chosen for the remaining factor 1 item because it had a high (.73) loading in the principal components analysis and it was conceptually congruent with the intended conceptualization of autonomy. Items 1, 3, and 30 were selected for the remaining factor 2 items based on their principal components loadings and their meaning. (For example item 3 had a loading of 0.6 in the principal components analysis which was lower than item 9 (.68) but item 9 was not as close to the intended conceptualization of autonomy or to what is relevant for a nurses in Alberta as was item 3. This resulted in the following ten items being included in the questionnaire:

IN MY PRACTICE I . . .
a.....take responsibility and am accountable for my actions
b.....have developed the image of myself as an independent professional
c.....base my actions on the full scope of my knowledge and ability
d.....take control over my environment and the situations I confront
e.....have a sense of professionalism
f.....make my own decisions related to what I do
g.....have the power to influence the decisions and actions of others
h.....demonstrate mastery of skills essential for freedom of action
i.....establish the parameters and limits of my practice activities
j.....accept the consequences for the choices I make

Responses were coded: 1=not at all true, 2=slightly true, 3=moderately true, 4=very true, 5=extremely true. The scale was scored according to the instructions; no weighting was required, items were simply summed, and none of the items used in the research utilization study required reverse coding.[9] The alpha reliability coefficient for the 600 cases comprising the final dataset used in the original analysis was 0.85 for the ten items used to form the abbreviated scale. The indicator in figure 6 for AUTONOMY is y_{15}.

Problem Solving Ability (η_{16})[10]

Ten items from the 32 item *Problem Solving Inventory* which measures individuals' appraisal of their problem solving abilities, were selected for inclusion in the

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[9]Scoring instructions are available from Dr. Dempster at the College of Nursing, University of Arizona (Tucson).

[10]The original use of the terminology problem solving "style" was influenced by the psychology literature in which investigators has been able to measure a concept they labelled "style". I was not able to do this, and on reflection an individual's "ability", or in this case their assessment of that ability, seemed more congruent with an influence on use of research in practice.

survey questionnaire. The Problem Solving Inventory (PSI) is composed of three subscales: (1) problem-solving confidence, (2) approach-avoidance style, and (3) personal control. Development of the PSI was done by Heppner[11] using traditional factor analytic approaches. Psychometric properties of the PSI are reported in the PSI Manual, and were of sufficient strength that, in conjunction with the PSI's relatively wide spread use and its approximation of the conceptualization of problem solving ability in this survey, it was decided to utilize the PSI.

Five items from sub-scale 1 (problem-solving confidence) and five items from sub-scale 2 (approach-avoidance style) with the highest factor loadings were selected. Items were selected from both sub-scales because items from both reflected the original investigator's conceptualization of problem solving ability. Heppner states that the items on sub-scale 3 may measure impulsiveness or feelings of inadequacy, and as such were not of interest in this study. Heppner also reports that this third scale (personal control) has not replicated well.[12] Additionally, it has only 5 items total (the others have 11 and 16). The items selected and their factor loadings in parentheses were:

Sub-scale 1: 10 (0.63), 23 (0.73), 24 (0.75), 27 (0.71), 34 (0.65)
Sub-scale 2: 7 (0.53), 13 (0.59), 15 (0.49), 18 (0.71), 31 (0.58)

The ten items selected were:

a. When I have a problem, I think of as many possible ways to handle it as I can until I can't come up with any more ideas
b. I have the ability to solve most problems even though initially no solution is immediately apparent
c. When confronted with a problem, I tend to do the first thing that I can think of to solve it
d. When considering solutions to a problem, I do not take the time to assess the potential success of each alternative
e. When making a decision, I compare alternatives and weigh the consequences of one against the other
f. Given enough time and effort, I believe I can solve most problems that confront me
g. When faced with a novel situation, I have confidence that I can handle problems that may arise
h. I trust my ability to solve new and difficult problems

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[11]Heppner, P. P. (1988). *The Problem Solving Inventory Manual*. Palo Alto, CA: Consulting Psychologists Press, Inc. This manual and accompanying questionnaires and scoring instructions were purchased from Consulting Psychologists Press, Inc, 577 College Avenue, Palo Alto, CA.

[12]Ibid.

i. When confronted with a problem, I usually first survey the situation to determine the relevant information
j. When confronted with a problem, I am unsure of whether I can handle the situation

Responses were coded: 1=strongly disagree, 2=moderately disagree, 3=slightly disagree, 4=slightly agree, 5=moderately agree, 6=strongly agree. Heppner's original scales are scored so that a low score indicates greater problem solving ability. In order to maintain consistent direction in the likert like scales in the research utilization survey questionnaire, the values were reversed so that a high score (6) reflected greater problem solving ability and a low score (1) less. Following the scoring instructions items for the PSI where identified items must be reverse scored, items c, d, and j from the research utilization survey were reverse coded before a summation of the ten was made. The alpha reliability coefficient for the 600 cases comprising the final dataset used in the original analysis was 0.74 for the ten items used to form an abbreviated scale of Problem Solving Ability (PSA). The indicator in figure 6 for PSA is y_{16}.

Belief (η_{17})

Belief was formed from the following two sets of three questions: "How ***willing*** are you to implement research when it contradicts something you....

a. learned *prior* to nursing school
b. learned *in* nursing school
c. learned in your place of work"

Responses were coded on a scale from 1 to 5, where 1=very unwilling and 5=very willing.

The second set of questions were: "How often do you ***actually implement*** research when it contradicts something you....

a. learned *prior* to nursing school
b. learned *in* nursing school
c. learned in your place of work"

Responses were coded on a five point scale where 1=never and 5=very often.

The reformulation was done as follows: (I) BELIEFI: The scores for the first set of three items were summed to create the variable, BELIEFI where the "I" represents intent, or the potential for research findings to be congruent with the belief system of the nurse in the three contexts of those items (range 3-15); (ii) BELIEFA: The scores for the second three items were summed to create the variable, BELIEFA where the "A"

represents action, or the frequency with which the subject has implemented research findings and hence their actual congruence with the belief system of the nurse, in the three contexts of the second set of items (range 3-15); (iii) BELIEFT: The scores for BELIEFI and BELIEFA were summed to create the variable BELIEFT, where the "T" represents a total belief score (range 6-30). The alpha reliability coefficient for this six item BELIEFT "scale" was 0.87. A higher score is associated in each case with higher amounts of belief. The indicator in figure 6 for BELIEFT is y_{17}

Cosmopoliteness(η_{18})

Cosmopoliteness (COSMOPOL), the degree to which a nurse is oriented outside the immediate work sphere, was formed by summing the scores on five variables, CONFLOCN, JOURNAL, number of interest groups, number of AARN meetings, and number of union meetings.

CONFLOCN (location of conferences attended), was formed by summing the scores on the following question: "In the **last five years** have you attended conferences or conventions that have been:

(Circle all that apply)

a. in Alberta.....	YES	NO
b. in the rest of Canada.....	YES	NO
c. in the United States.....	YES	NO
d. outside of North America.....	YES	NO

A yes response received a 1 and a no response a 0, making it possible to score 4 on this question.

JOURNAL, the frequency with which nursing journals were read, was formed by summing the scores on the question: "How often have you read the following nursing journals in the past year? AARN Newsletter, Canadian Nurse, Nursing '96, American Journal of Nursing, RN, Nursing Research, Canadian Journal of Nursing Research, Heart & Lung." Responses were scored (in times per year): 0=never, 2=once, 2=2-4, 3=5-7, 4=8-10, 5= >10.

The number of interest groups a nurse belonged to was calculated from the question: "How many nursing interest groups or organizations do you presently belong to? (e.g., Cdn. Intravenous Nurses Assoc., oncology nurses interest group, holistic nurses interest group, etc.). Put "0" if none." Responses were scored as the number the respondents wrote down.

The number of AARN and union meetings attended in the last year was obtained from the question: "How many of the following meetings have you attended in the past year?"

AARN council or district.....
Union.....

Responses were scored as the number the respondents wrote down. The sum of these five variables was taken and used as the indicator (y_{18}) for COSMOPOL.

Dogmatism (η_{19})

The first ten of 20 items on the short form of Rokeach's (1956) Dogmatism Scale (original scale has 40 items) were used according to the advice in Troldahl and Powell (1965). The average R given by Troldahl and Powell for these ten items ranged from 0.60 to 0.51. The dogmatism scale was originally developed by Rokeach in the 1950s and was designed to measure individual differences in open versus closed belief systems. It has generally been put forth as a generalized theory of authoritarianism (Rokeach, 1960). It is widely available, existing in the public domain (Robinson, Shaver & Wrightsman, 1991). The ten items in this questionnaire are scored as they appear, that is, they require no recoding or reverse coding. The alpha reliability coefficient for the 600 cases comprising the final dataset used in the original analysis was 0.72 for the ten items used in the short form of the dogmatism scale. The indicator in figure 6 for DOGMATISM is y_{19}.

Trust (η_{20})

Trust, the degree of faith that the nurse has that nurse researchers produce research findings that are relevant, easily used, and safely used, was formed from the following questions: "How much faith do you have that nurse researchers will produce research. . .

a. that is **relevant** to you?
b. that is **easily used** by you?
c. that can **safely** be used in your practice?"

Responses were coded on a scale from 1 to 5, where 1=none and 5=a great deal. The scores on the three questions were summed creating a range from 3 to 15, with higher scores reflecting more trust. The alpha coefficient for this three item trust "scale" was .91. The indicator in figure 6 for TRUST is y_{20}.

Scaling and Reliability in LISREL

As was done in phase one, scale equivalence was ensured by fixing the lambda (λ) value to 1.0 for each concept. That is, the structural coefficients between each concept and its corresponding indicator were fixed at 1.0 ensuring that each concept was measured on the same measurement scale as its indicator. Measurement reliabilities were all fixed rather than permitted to be free (i.e., the error variance was fixed). The diagonal elements of the Θ matrix were each assigned error variance as follows. Each of

the indicators (y_8 to y_{21}) was assigned an error variance of 1% except THORIENT (y_8), ATTITUDE (y_{14}), BELIEFT (y_{17}) and TRUST (y_{20}) which were each assigned 5%. The assignment of a 1% error variance to nine of the 13 newly introduced variables reflects a high degree of confidence in the reliability of the indicators. The 1% is permitted to account for honest mistakes in answering questions and for coding errors. The more moderate 5% error variance in the remaining four indicators reflects my belief that, while still reliable indicators of the intended concepts, three of these indicators (theoretical orientation, belief, and trust) have no previous "track record" as measures of these concepts and may have been open to some misinterpretation by the respondents. The fourth indicator, attitude was assigned 5% error variance because I had some concern that response to the six attitude questions had been influenced by social desirability.

Univariate Summary Statistics for the Indicators

The statistics describing the original seven indicators in model 1, plus the additional 13 indicators added in this phase are presented in Table 5. These statistics are based on the respondents in the first randomly split half of the data (rusplit1).

The Covariance Matrix

The covariance matrix for Model 2 was created using pairwise deletion of missing cases. This resulted in an effective sample size ranging from 175 to 300 out of a total sample size of 300. The average sample size was used to run the LISREL program.[13] Missing values for the pairs of variables in the matrix ranged from 3.33% to 41.67%. A listwise deletion would have resulted in only 130 useable cases with which to do the phase two modeling. The actual matrix is located in Appendix D.

Model Estimates, Model Fit and Model Modifications

Estimates of the model in figure 6 were obtained using maximum likelihood estimation (MLE) and model fit was assessed by examining χ^2, the adjusted goodness of fit (AGF) index, the size of the standardized residuals, and other parameters. Estimation of the model in figure 6 resulted in: χ^2=76.67, *df*=60, p=.072, and AGF=.907. I had hoped that in addition to indices such as these which suggested a salvageable model, that I would find direction in other diagnostic information from this run. Neither the residual pattern, or the modification indices suggested any striking benefit would be gained by adding effects from any of η_8 through η_{20}, to η_{21} , although the modification indices revealed modest indices for ACTIVISM (5.605), ATTITUDE (6.391), and PSA (6.388),

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[13]The average sample size was calculated at 267 for the first three runs described here (a,b,c) and re-calculated subsequently in this and subsequent phases each time a model was run using a different number of variables. This was done because of the influence of sample size on χ_2 and standard errors. For the final model described in this section (d) the average sample size was calculated at 257.

Table 5. Statistics for the Indicators in Model 2: The Causal Role of Individual Factors

Indicator	Range	Mean	Std Dev	Skewness	Kurtosis
RUO#1 (y_1)	1-7	4.163	1.917	0.017	-1.168
RUO#2 (y_2)	1-7	4.657	1.841	-.201	-1.103
RUO#3 (y_3)	1-7	4.705	1.762	-.210	-1.086
RUO#4 (y_4)	1-7	4.628	1.773	-.246	-1.052
RUDIRECT (y_5)	1-7	4.360	1.902	-.021	-1.182
RUINDIR (y_6)	1-7	5.203	1.824	-.773	-.499
RUPERSUA (y_7)	1-7	3.603	1.763	.368	-.964
THORIENT (y_8)	1-5	3.540	1.174	-.567	-.322
ACTIVISM (y_9)	3-28	14.964	5.029	-.652	.796
AFFILC (y_{10})	0-1	.063	.244	3.603	10.944
AFFILO (y_{11})	0-1	.018	.132	7.375	52.209
AFFILP (y_{12})	0-1	.127	.333	2.256	3.077
AFFILU (y_{13})	0-1	.120	.325	2.355	3.535
ATTITUDE (y_{14})	15-30	24.437	2.281	-.403	.507
AUTONOMY (y_{15})	26-50	40.630	4.675	-.048	-.396
PSA (y_{16})	30-60	47.307	5.393	-.137	.091
BELIEFT (y_{17})	6-30	20.848	4.741	-.218	-.165
COSMOPOL (y_{18})	0-39	12.530	6.369	1.068	1.694
DOGMATSM (y_{19})	10-56	28.087	8.254	.388	.284
TRUST (y_{20})	3-15	9.767	2.690	.077	-.210

and a slightly more encouraging index for COSMOPOL (11.403).[14] These rather equivocal results did not point clearly toward further model modification. This was both disappointing and surprising to me; I was quite certain that several of the newly introduced variables were theoretically important. Because I had, as noted at the beginning of the this chapter, permitted all possible covariances, but no direct effects from the newly introduced concepts to *real research utilization*,[15] I decided to modify my approach somewhat and attempt a model where all direct effects from η_8 through η_{20} to η_{21} were permitted. The results of this run would provide additional diagnostic information to be assessed, namely t-values--where effects that were significant should be evident.

Estimation of this second model (referred to as *2b* for clarity) with all direct effects from η_8 through η_{20}, to η_{21} permitted, resulted in: χ^2=47.91, *df*=47, p=.436, and AGF=.923. No remarkable pattern was observed in the standardized residuals; only eight residuals were greater than an absolute value of two (but less than three) and these were scattered unsystematically throughout the matrix. None of these residuals suggested theoretically logical changes that might be reflected in the modification indices. Accordingly, examination of the modification indices did not suggest any theoretically plausible changes. However, an examination of the t-values for significant effects revealed surprising results. Contrary to my expectations that several of the 13 newly introduced variables would exert significant effects, only two, problem solving ability (PSA) and cosmopoliteness (COSMOPOL) had t-values of 2 or greater.[16] This result, while being reasonably consistent with a strategy of omit and possibly reinsert, and despite there being limited research in this area, was devastating to my personal expectation, that is, to my theoretical stake in this modeling exercise. My understanding of the literature and my own observations and deductions had led me to propose this particular set of concepts with confidence. In particular, I could not believe that activism, attitude, autonomy and affiliation were not key concepts in determining the influence of individual factors on research use. In particular the literature directly and consistently asserts that a positive attitude is a significant cause of research utilization. It also asserts indirectly, that is, by implication, that autonomy ought to exert a positive influence. In

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[14]Hayduk (personal communication, March 31, 1995) suggests based on his experience that making model changes based on modification indices less than ten in magnitude may be a reaction to sampling fluctuations, but the precise value depends on many things, most notably the number of modification indices scanned.

[15]This approach was chosen, as noted earlier because it required the minimum number of parameter estimations, the logic being that one leaves out the effects and lets the modification indices drive their insertion. In an admittedly data driven series of exercises, the fewer parameter estimations required the fewer demands placed on the data.

[16]*T-values (>±1)*: PSA=2.014, COSMOPOL=2.721, ACTIVISM=1.886, ATTITUDE=1.482, AUTONOMY=-1.165, AFFILU=-1.664.

this case, not only had autonomy not reached the admittedly somewhat arbitrary t-value of ±2, but its effect was a negative one, that is, the more autonomous a nurse, the less likely she is to use research. There was some consolation in the indications that a nurse who "affiliates" most closely with a union (AFFILU) is less likely to use research because that was the direction I would have predicted. However, it must be remembered that AFFILU was a variable that had to be created by creating five dummy variables and entering four of them into the equations. Hence, all that we could really infer from any significant effects from AFFILU is that those nurses who felt most affiliated with the union were somehow different than those nurses who felt most affiliated with their workplace (the reference group AFFILW).

What did the runs of models 2a and 2b then suggest to me? First, they suggested that most of these concepts exert no direct effect on research utilization, although two may (PSA and COSMOPOL). Second, it is unclear what the nature of their connections to direct, indirect and persuasive research utilization are (η_5, η_6 and η_7). No effects are suggested in the output of this run. It is likely that any effects (i.e., through η_5, η_6 or η_7) are camouflaged within the covariances among the background concepts. I was left then with the notion that direct, indirect and persuasive research utilization remain strong predictors of overall research utilization, even after controlling for η_8 to η_{20}. And that I might have two additional predictors, but certainly not the larger set I had envisioned. The only way any of the remaining 11 variables would function in the model would be through η_5, η_6 and η_7.

Prior to proceeding with the next phase of modeling, where another set of concepts would be introduced (concepts that had originally been conceptualized as the "true" background concepts) I ran this model (2b) with direct effects to η_{21} permitted only from PSA (η_{16}) and COSMOPOL (η_{18}) and called this model 2c. This resulted in: χ^2=59.73, *df*=58, p=.413, and AGF=.925 and no remarkable diagnostic information. I elected to only permit direct effects from PSA and COSMOPOL, rather than also keep concepts such as ATTITUDE, AUTONOMY, ACTIVISM and AFFILU which I might have argued were theoretically probable and which had had t-values ranging from -1.664 to 1.886 and so could be argued were not outrageous inclusions.

One last step was taken with which to construct a model to take forward into phase three. The 11 concepts that were not significant were dropped from this model 2c resulting in a return to the basic structure of the core model from the previous chapter with the addition of PSA and COSMOPOL (see figure 7). This resulted in an assessment of model fit as follows: χ^2=13.05, *df*=14, p=.523, and AGF=.964. Explained variances for this final model 2 were again very high with values as follows[17]:

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[17]The real or actual variance in REALRU was 3.852. Again as in chapter 5, the derivation of the explained variance in this unmeasured concept is evident, i.e., R^2=1-(1÷3.852=.7404=.740.

RUO#1 (η_1)	RUO#2 (η_2)	RUO#3 (η_3)	RUO#4 (η_4)	DIRECT (η_5)
.563	.708	.817	.797	.000

INDIR (η_6)	PERSUA (η_7)	PSA (η_8)	COSMOPOL (η_9)	REALRU (η_{10})
.000	.000	.000	.000	.740

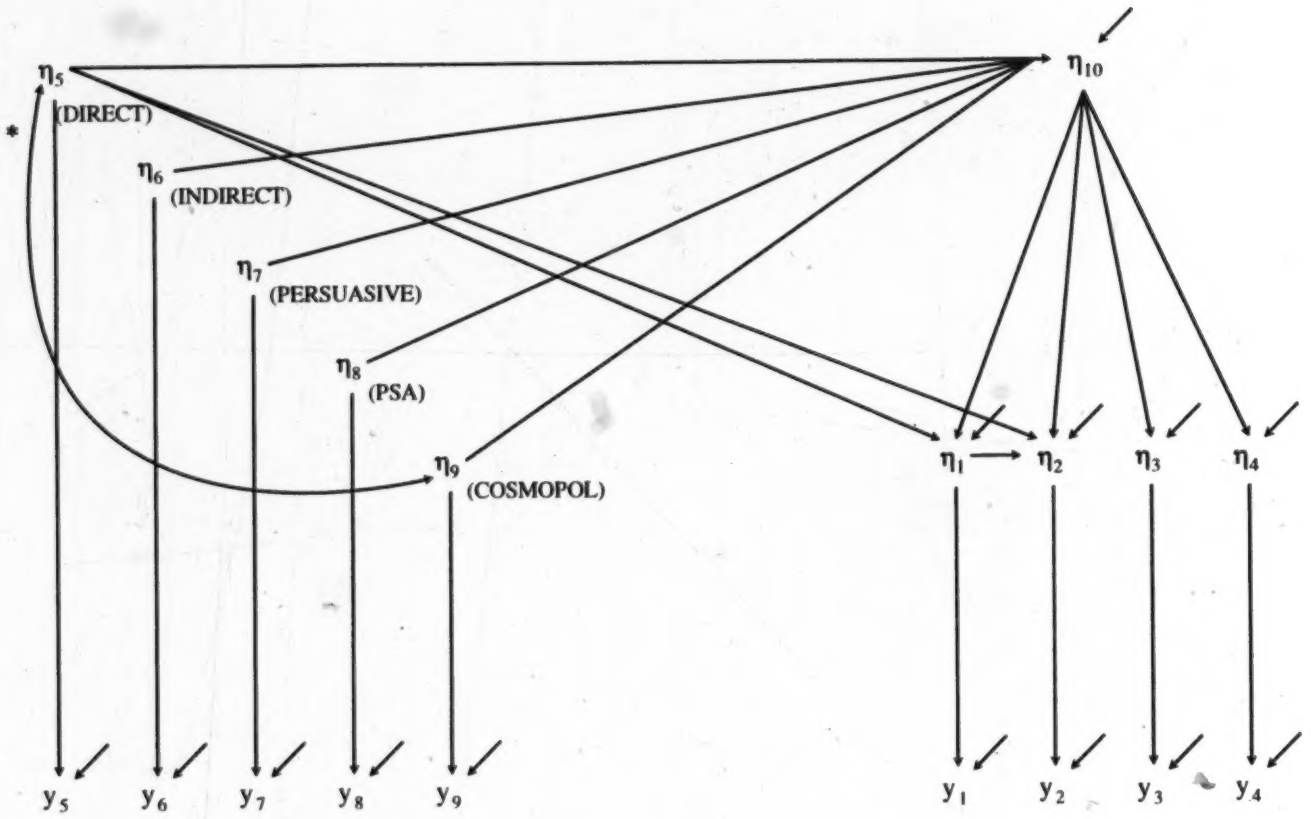
The t-values for the beta coefficients, all of which were significant, in this model were:

BE(2,1)	BE(1,5)	BE(2,5)	BE(1,10)	BE(2,10)	BE(3,10)
7.435	2.127	4.772	7.008	2.700	13.348
BE(4,10)	BE(10,5)	BE(10,6)	BE(10,7)	BE(10,8)	BE(10,9)
13.206	9.351	5.068	2.231	2.179	3.168

Summary

The final model depicted in figure 7 forms an intermediary model constructed originally from the best available indications in the literature and in the investigator's experience; and secondarily from data implications. It is referred to during the reminder of the chapters as *Model 2*. The final version of model 2 which demonstrates quite good fit, although falling short of a probability of .75 (.413) and AGF of .96 (.925) was arrived at after four steps which have been outlined and which incorporated one major set of theoretical modifications--the elimination of all but two of the 13 concepts added in this phase. I arrived at a model which asserts that: (1) direct, indirect, and persuasive research utilization remain as strong predictors of research utilization, even controlling for η_8 to η_{20}, (2) problem solving ability and cosmopoliteness are also tentative predictors of research utilization, and (3) whatever other effects the remaining eleven concepts in this phase exert, they must work indirectly on research utilization through direct, indirect, and persuasive research utilization. The theoretical implications of this intermediary model are quite significant and if born out in phase 3 of the modeling, and during the validation phase will run counter to a significant proportion of the nursing literature in the field.

Figure 7. Final Model 2: The "Core Model" with Two Individual Factors added.



*all possible covariances permitted

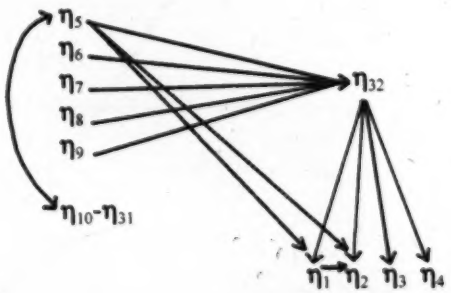
Chapter 7

Factors Influencing Research Utilization

In this chapter phase three of the modeling work is presented. In this phase background, or exogenous, factors were added to the functioning model 2 (figure 7) described in the previous chapter. This work resulted in an acceptably fitting model 3.

The Conceptual Model

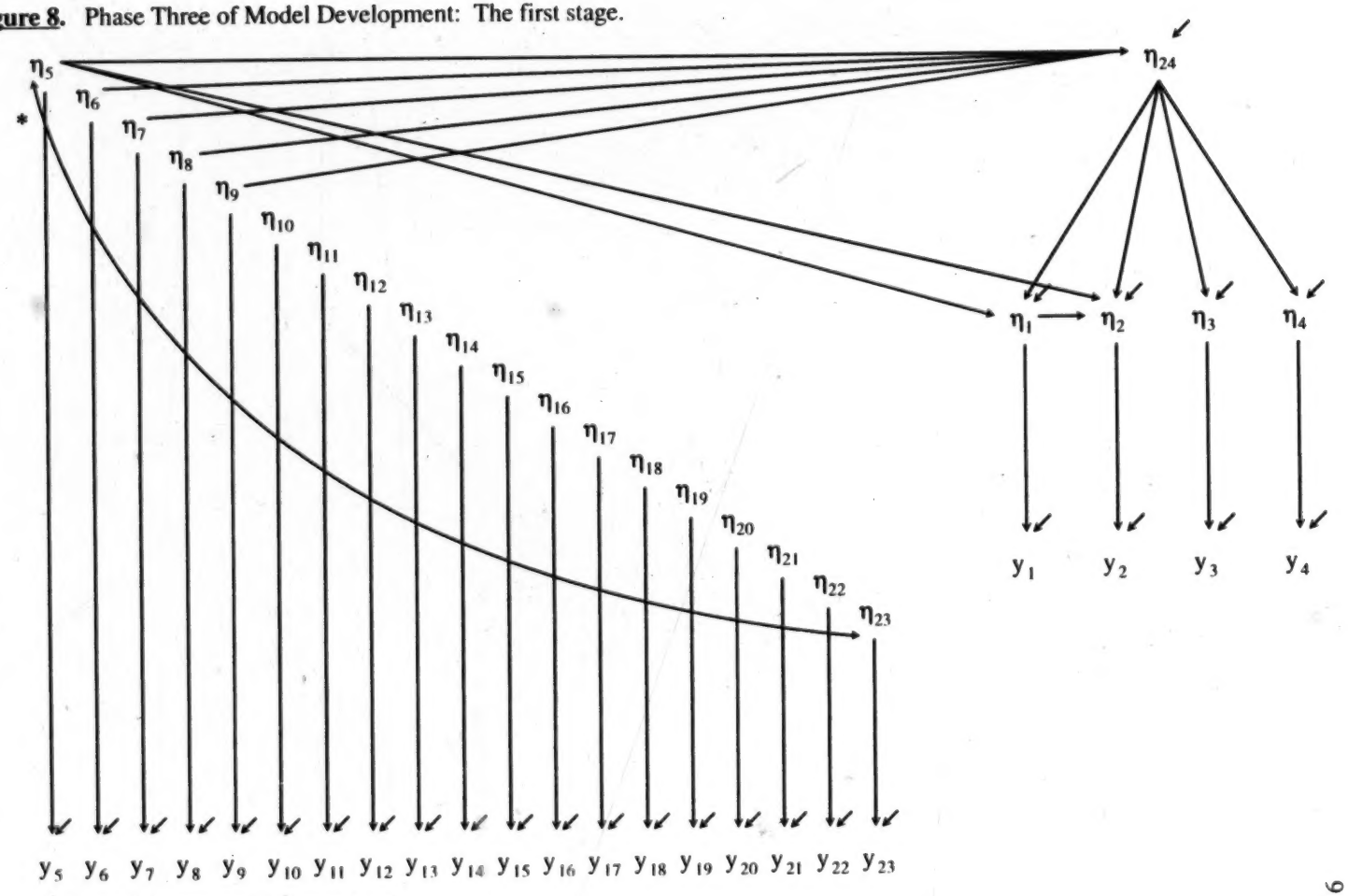
Working again with an all η model (figure 8) and taking the same approach as was developed in the second phase of modeling, the plan in this phase was to add 22 background concepts to model 2 as η_{10} to η_{31}, permitting all covariances among η_5 to η_{31}, but no additional effects (beyond what were permitted in model 2, to η_1 to η_4 or to η_{32}[1]. Using the diagnostic information from these runs, additional effects that were statistically indicated and conceptually sound would be specified and assessed. This model development plan can be pictured as:



However, when this model was run, unreliable parameter estimates were obtained because there were more coefficients to be estimated (415) than there were cases (n=282). Rather than abandon the strategy of reserving half of the data for an uncompromised

[1]The phantom concept (real research utilization) was held as the last numbered η in all of the modeling exercises. Thus, what was η_8 in the first model, and η_{10} in model 2, is now η_{32} in the first stage of developing model 3.

Figure 8. Phase Three of Model Development: The first stage.



*all possible covariances permitted

assessment of the final model[2], I decided to eliminate eight of the variables from this stage of modeling, with the intent of retaining the possibility of re-introducing these variables at a later date. Of the 22 concepts being entered at this point, the eight dummy variables were eliminated. Three of these dummy variables specified day, evening or night shift work, and five specified different clinical areas. These eight variables were chosen because: 1) only two concepts were eliminated using these eight dummy variables, and 2) literature support for these two (clinical area and shift worked) was not strong.

The Statistical Model

Each concept in this stage of modeling (figure 8) had a single indicator. In this section the operationalizing of the conceptual model is presented, that is, each concept and its corresponding indicator is described. Included are: question wordings, examples used to clarify meanings, and coding used. The measures of the concepts entered in this phase were all single indicators.

Age (η_{10})

Age was measured by responses to the question: "In what year were you born?" The value on this variable was then subtracted from 96 to form age. The indicator in figure 8 for age is y_{10}.

Sex (η_{11})

Sex was measured by the question: "Are you..... FEMALE
MALE"

The indicator in figure 8 for sex is y_{11}.

Income (η_{12})

Income was measured by the question: "Which of the following categories best describes your **total household** income for this past year <u>before</u> taxes and other deductions?"

Less than $10,000..... 1
$10000 to $19,999..... 2
$20,000 to 29,999..... 3
$30,000 to 39,999..... 4

---

[2]Abandoning this strategy would have permitted recombination of the two split data sets into a larger data set with an optimal n of 600, although the actual sample size used in each model would vary as have the average sample sizes used thus far due to the use of a pairwise covariance matrix.

$40,000 to 49,999.....	5
$50,000 to 59,999.....	6
$60,000 to 69,999.....	7
$70,000 to 79,999.....	8
$80,000 to 89,999.....	9
$90,000 to 99,999.....	10
$100,000 or more.....	11

The indicator in figure 8 for income is y_{12}.

Years since last education (η_{13})

Years since last education (YRLASTED) was measured using the question: "When did you complete your highest level of nursing education?" The value on this variable was then subtracted from 96 to form YRLASTED. The indicator in figure 8 for YRLASTED is y_{13}.

Job Satisfaction (η_{14})

Job satisfaction (JOBSAT) was measured by the question: "Overall, how satisfied are you with your present job?" Responses were coded on a scale from 1 to 5, where 1=very dissatisfied and 5=very satisfied. The indicator in figure 8 for JOBSAT is y_{14}.

Marital Status (η_{15})

Marital status (MARITALD) was measured using the question: "What is your current marital/partner status?"

Married (and living with spouse).....	1
Living with partner/living common-law.....	2
Single.....	3
Separated, widowed, divorced.....	4
Other (Please specify:_____).....	5

Responses were recoded so that 1=married and 0=not married. The indicator in figure 8 for MARITALD is y_{15}.

Education (η_{16})

Education (EDUCHIGH) was conceptualized as being the highest level of formal education achieved and was measured by the question: "What is your highest completed level of formal nursing education?"

Diploma..... 1
Bachelor's Degree..... 2
Master's Degree..... 3
Other (Specify:_____)..... 4

The indicator in figure 8 for EDUCHIGH is y_{16}.

Years Worked (η_{17})

The number of "real" years worked (YRSWORK) was measured by responses to the question: "Excluding your basic nursing training, how many years have you worked as a nurse? Do not count periods where you did not work for 6 months or more." The indicator in figure 8 for YRSWK is y_{17}.

Health and Lifestyle Activity (η_{18})

Health and lifestyle activity (HLSA) was operationalized as the number of hours per week that respondents spent in a series of activities. It was arrived at by summing the scores on c, d, and e from the question below: "On average, how many **hours per week** do you spend:

a._____ With your children
b._____ With dependent adults
c._____ In recreational or competitive exercise
d._____ On political activity
e._____ In community service work (e.g., community league, school activities, distress lines, food banks, church activities, associations such as diabetes and cancer, shelters, boys and girls clubs, etc.)"

The indicator in figure 8 for HLSA is y_{18}.

Inservices Attended (η_{19})

The number of inservices attended (RINSERV) was operationalized with part "b" of the question: "How many continuing education and/or inservice sessions (½ to 4 hr. duration):

a. Do you attend in an average year..... NUMBER_____
b. Did you attend in the past 12 months..... NUMBER_____"

The indicator in figure 8 for RINSERV is y_{19}. The responses to this question contained a few severe outliers and these were collapsed into more contiguous categories to eliminate any effects of severe outliers.

Courses Attended (η_{20})

The number of courses attended (RCOURSES) was measured with the question: "How many statistics and/or research courses have you ever taken? Indicate "0" for NONE". The indicator in figure 8 for RCOURSES is y_{20}.

Hours per Week Presently Working (η_{21})

The hours per week presently working (HRWKPRES) were measure by "a" from the question: "On average. . . .

a. how many **hours per week** do you presently work? _____hr/wk
b. how many **hours per week** did you work last year? _____hr/wk
c. how many **hours per week** did you work in the last five years? _____hr/wk"

The indicator in figure 8 for HRWKPRES is y_{21}.

Dependant Care Hours (η_{22})

Dependant care hours (DCHX)were the total of the ranges of hours that respondents reported they spent each week on average caring for either dependant children or dependant adults. It was first obtained from section "a" and "b" of the following question: " "On average, how many **hours per week** do you spend:

a._____ With your children
b._____ With dependent adults
c._____ In recreational or competitive exercise
d._____ On political activity
e._____ In community service work (e.g., community league, school activities, distress lines, food banks, church activities, associations such as diabetes and cancer, shelters, boys and girls clubs, etc.)"

Because the distributions on the responses were so skewed and because there were so many severe outliers, the totals were collapsed into a series of ranges:

Range	Value	Frequency
no hours	0	73
1 to 20 hours	1	73
21 to 40 hours	2	49
41 to 60 hours	3	50
61 to 80 hours	4	22
81 to 100 hours	5	09
101 to 120 hours	6	03

121 to 140 hours.....	7	06
141 to 160 hours.....	8	05
more than 160 hours.....	9	01

The indicator in figure 8 for DCHX is y_{22}.

Shift Satisfaction (η_{23})

Shift satisfaction (SHIFTSAT) was measured with the question: "How satisfied are you with the shift schedule that you currently work?" Responses were coded on a scale from one to five, where 1=very dissatisfied and 5=very satisfied. The indicator in figure 8 for (SHIFTSAT) is y_{23}.

Scaling and Reliability in LISREL

As was done in phases one and two, scale equivalence was ensured by fixing the lambda (λ) value to 1.0 for each concept. That is, the structural coefficients between each concept and its corresponding indicator were fixed at 1.0 ensuring that each concept was measured on the same measurement scale as its indicator. Measurement reliabilities were all fixed rather than permitted to be free (i.e., the error variance was fixed). The diagonal elements of the Θ matrix were each assigned error variance as follows.

Variable	Error Variance	Rationale
AGE (y_{10})	0.5%	To allow for any coding error and any under reporting
SEX (y_{11})	0.1%	To allow for any coding error
INCOME (y_{12})	5%	To allow for over/under reporting on a variable known to be sensitive
YRLASTED (y_{13})	2%	To allow for any misinterpretation between years since last and basic education
JOBSAT (y_{14})	1%	To allow for honest mistakes in answering and for coding errors
MARITALD (y_{15})	1%	To allow for honest mistakes in answering and for coding errors
EDUCHIGH (y_{16})	5%	To allow for possible confusion between highest and basic education and education that may not have fit the coding categories

YRSWORK (y_{17})	5%	To allow for any miscalculation originating in the instruction to not count absence periods of six months or more
HLSA (y_{18})	10%	To allow for error in calculating, some respondents may not have included or may have excluded activities or under/over estimated hours
RINSERV (y_{19})	10%	To allow for confusion as to what may have constituted an inservice, some responses suggested more inservices than were likely to have occurred
RCOURSES (y_{20})	1%	To allow for honest mistakes in answering and for coding errors
HRWKPRES (y_{21})	5%	To allow for honest mistakes in answering, difficulties calculating hours, and for coding errors
DCHX (y_{22})	10%	To allow for error in calculating, hours with children were not clearly defined and hours with dependant adults may have been confused with adults in the care setting
SHIFTSAT (y_{23})	1%	To allow for honest mistakes in answering and for coding errors

As with earlier error assignments, a 2% or less error variance reflects a high degree of confidence in the reliability of the indicator. The more moderate 5% error variance reflects my belief that, while still reliable indicators of the intended concepts, these indicators have a higher likelihood of containing measurement error. The more significant 10% error variance suggests that I expect a higher degree of measurement error was introduced, usually when calculations and estimates had to be made or when responses to a question suggested some confusion. In no instance did I consider the indicators to be so loosely connected to the concepts that more than 10% error variance should be assigned.

Univariate Summary Statistics for the Indicators

The statistics describing the original seven indicators in model 1, the two additional indicators from model 2, and the 14 additional indicators added in this phase are presented in Table 6. These statistics are based on the respondents in the first randomly split half of the data (rusplit1).

Table 6. Statistics for the Indicators in Model 3: Factors Influencing Research Utilization

Indicator	Range	Mean	Std Dev	Skewness	Kurtosis
RUO#1 (y_1)	1-7	4.163	1.917	0.017	-1.168
RUO#2 (y_2)	1-7	4.657	1.841	-.201	-1.103
RUO#3 (y_3)	1-7	4.705	1.762	-.210	-1.086
RUO#4 (y_4)	1-7	4.628	1.773	-.246	-1.052
RUDIRECT (y_5)	1-7	4.360	1.902	-.021	-1.182
RUINDIR (y_6)	1-7	5.203	1.824	-.773	-.499
RUPERSUA (y_7)	1-7	3.603	1.763	.368	-.964
PSA (y_8)	30-60	47.307	5.393	-.137	.091
COSMOPOL (y_9)	0-39	12.530	6.369	1.068	1.694
AGE (y_{10})	21-62	41.387	9.347	.006	-.889
SEX (y_{11})	0-1	0.973	0.161	-5.906	32.767
INCOME (y_{12})	1-11	6.919	2.552	-.035	-.956
YRLASTED (y_{13})	0-38	15.465	9.912	.295	-1.051
JOBSAT (y_{14})	1-5	3.502	1.118	-.559	-.400
MARITALD (y_{15})	0-1	0.782	.414	-1.372	-.117
EDUCHIGH (y_{16})	1-4	1.361	.654	2.241	5.718
YRSWORK (y_{17})	1-36	14.453	8.134	.253	-.729
HLSA (y_{18})	0-46	6.910	6.351	2.784	12.081
RINSERV (y_{19})	0-14	4.936	4.025	.821	-.443
RCOURSES (y_{20})	0-4	.685	1.039	1.351	.927
HRWKPRES (y_{21})	0-60	28.118	11.538	-.258	-.382
DCHX (y_{22})	0-9	1.935	1.866	1.269	1.703
SHIFTSAT (y_{23})	1-5	3.570	1.335	-.563	-.832

The Covariance Matrix

The covariance matrix for Model 3 was created using pairwise deletion of missing cases. This resulted in an effective sample size ranging from 175 to 300 out of a total sample size of 300. The average sample size was used to run the LISREL program.[3] Missing values for the pairs of variables in the matrix ranged from 3.33% to 41.67%. A listwise deletion would have resulted in only 140 useable cases with which to do the phase two modeling. The actual matrix is located in Appendix E.[4]

Model Estimates, Model Fit and Model Modifications

Estimates of the model in figure 8 were obtained using maximum likelihood estimation (MLE) and model fit was assessed by examining χ^2, the adjusted goodness of fit (AGF) index, the size of the standardized residuals, and other parameters. Estimation of the model in figure 8 resulted in: χ^2=158.01, *df*=79, p=.000, and AGF=.852. Examination of the standardized residuals revealed many with a value greater than an absolute value of two (range: -5.519 to 4.296), however, there was no pattern to the residuals suggesting ill fit throughout. Because, as with model 2, these rather equivocal results did not point clearly toward further model modification, I again elected to attempt a model where all direct effects from η_{10} through η_{23} to η_{24} were permitted.[5] The results of this run would provide additional diagnostic information to be assessed, namely t-values.

Specification and estimation of this model resulted in: χ^2=82.59, *df*=56, p=.012, and AGF=.882. The standardized residuals again did not reveal a pattern or suggest theoretically logical changes that might be reflected in the modification indices. Expectedly, examination of the modification indices did not suggest any theoretically plausible changes. Examination of the t-values was, as had been the case in developing model 2, disappointing. Of the 14 additional concepts entered into this third modeling stage, only two, inservices attended (RINSERV) and hours per week currently worked (HRWKPRES) reached a critical absolute value of two or more. Further the direction of the influence of HRWKPRES was in a different direction than I had anticipated. This

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[3]The average sample size was calculated at 276 for the first two runs described here and re-calculated subsequently in this and subsequent phases each time a model was run using a different number of variables. This was done because of the influence of sample size on χ^2 and standard errors.

[4]The covariance matrix found in appendix E contains the 24 variables discussed thus far and the eight variables eliminated from this stage of modeling for a total of 31 variables. The average "n" in this matrix is 282. This matrix can be used for all estimates achieved in this chapter as long as sample size is adjusted appropriately.

[5]As has been the case in earlier chapters, the phantom concept (real research utilization) is assigned the last η value in the series of η's; in this case it is η_{24}.

model suggested that the more hours a nurse worked in a week, the less likely she would use research. Once again, the implications of this were disastrous to my theoretical position and to that of much of the literature. Concepts such as research courses taken, highest level of education achieved and years since last education had been predicted to exert a statistically significant influence on research use by nurses.

Prior to proceeding I ran this model again with the nine concepts that formed model 2 and only the two concepts (RINSERV and HRWKPRES) that had reached a t value greater than ±2. This resulted in: χ^2=23.79, *df*=20, p=.251, and AGF=.947 and no remarkable diagnostic information other than a dropping of the t value for HRWKPRES (to -1.341).[6] I elected at this stage, to only permit direct effects from RINSERV and HRWKPRES, rather than also keep concepts such as job satisfaction (JOBSAT) and courses taken (RCOURSES) which I might have argued were theoretically probable and which had had t-values of 1.908 and 1.338 respectively.

A further model was assessed in which HRWKPRES was dropped and only RINSERV added to model 2.[7] This resulted in: χ^2=19.18, *df*=17, p=.318, and AGF=.953. This was judged to be a reasonable well fitting model although falling somewhat short of the rather stringent criteria discussed earlier (p≥.75 and AGF≥.96). The explained variances for the concepts in this model were (actual variance of REALRU was 3.948):

RUO#1	RUO#2	RUO#3	RUO#4	DIRECT
(η_1)	(η_2)	(η_3)	(η_4)	(η_5)
.566	.709	.813	.797	.000

INDIR	PERSUA	PSA	COSMOPOL	RINSERV	REALRU
(η_6)	(η_7)	(η_8)	(η_9)	(η_{10})	(η_{11})
.000	.000	.000	.000	.000	.747

The effects were all significant and t-values for the beta coefficients in this model were:

BE(2,1)	BE(1,5)	BE(2,5)	BE(1,11)	BE(2,11)	BE(3,11)
7.369	2.046	4.720	7.120	2.804	13.264
BE(4,11)	BE(11,5)	BE(11,6)	BE(11,7)	BE(11,8)	BE(11,9)
13.134	9.328	5.142	2.141	2.188	3.035

[6]Sample size for this run was 263.

[7]Sample size for this run was 260.

BE(11,10)
1.671

Before proceeding to the final stages of model development in this phase, I returned to the concepts that had been eliminated early in assessment of model 3, namely CLIN2 To CLIN6 and SHIFTDAY, SHIFTEVE and SHIFTNGH with the intent of reintroducing them to the model to determine if they exerted significant effects.

These concepts were operationalized as follows.

Clinical Area (y_{11})

Clinical area was measured by asking the question: "What is your primary clinical area (where you work the most hours)? Check one only."

__general medical
__general surgical
__pediatrics
__maternal/newborn
__psychiatric/mental health
__oncology
__operating/recovery room
__emergency care
__adult critical/intensive care
__pediatric critical/intensive care
__neonatal critical/intensive care
__several clinical areas (e.g., float or casual)
__ambulatory care
__geriatric/gerontology (acute care)
__geriatric/gerontology (long term care)
__rehabilitation (acute care)
__school health
__home care/home health
__community/public health
__occupational health
__independent practice (specify:_____)
__other (specify:_____)

The responses were grouped as follows[8]:

CLIN1: values 1-6, 13-15, 17=1 (general hospital nursing)
CLIN2: values 8-12=2 (critical care/specialized hospital nursing)
CLIN3: value 16=3 (geriatric/LTC nursing)
CLIN4: values 18, 20=4 (public health, school health nursing)
CLIN5: value 19=5 (home care nursing)
CLIN6: values 21 to 23=6 (other nursing)

For use in the modeling exercises, the six variables (CLIN1 to CLIN6) were recoded as dummy variables (1=yes, 0=no). CLIN1(the largest group) was held back from the

[8]The values assigned to the various responses were assigned sequentially, value 7 was not included. For example values 8 to 12 include operating room through neonatal intensive care.

equations as the reference group. The indicator for this variable was y_{11}.[9]

Shift Worked (y_{12})

Shift worked was measured with the question: "What shift do you usually work? (consider the past 12 months). Circle one."

8 hour days..... 9
12 hour days..... 8
8 hour evenings..... 7
8 hour nights..... 6
12 hour nights..... 5
Rotate between:
8 hr. (circle combination: D/N, D/E, E/N)..... 4
8 hr. D/E/N..... 3
12 hr. D/N..... 2
Other (specify:_____)..... 1

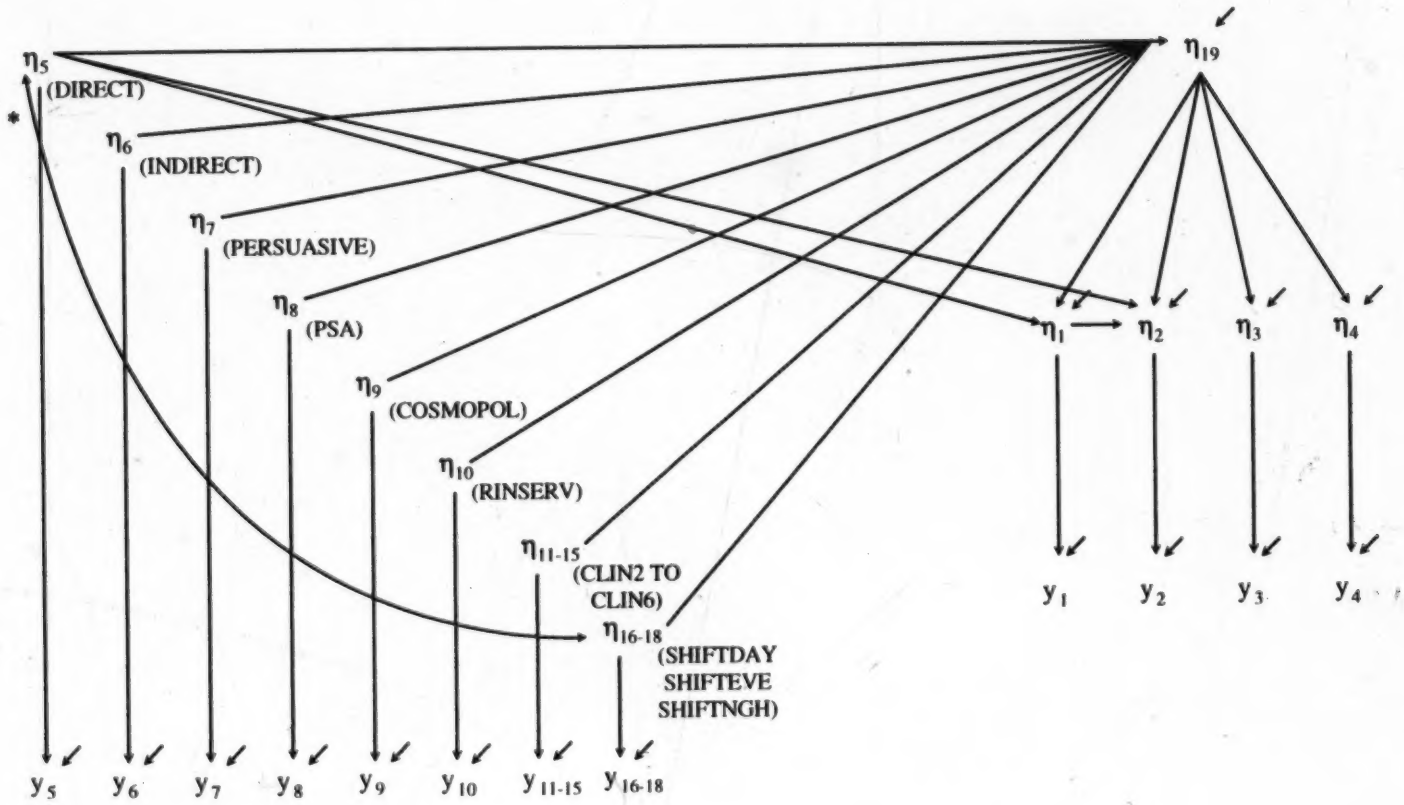
Responses were grouped into the categories and recoded as dummy variables where 1=yes and 0-no: days (SHIFTDAY), evenings (SHIFTEVE), nights (SHIFTNGH), and rotate (ROTATE). The rotate group which was the largest was held back from the equations as the reference group. The indicator for this variable was y_{12}.

The univariate statistics for these variables were:

Indicator	Range	Mean	Std Dev	Skewness	Kurtosis
CLIN2	0-1	.307	.406	1.456	.120
CLIN3	0-1	.193	.396	1.561	.435
CLIN4	0-1	.073	.261	3.290	8.795
CLIN5	0-1	.060	.238	3.724	11.830
CLIN6	0-1	.037	.188	4.955	22.482
SHIFTDAY	0-1	.288	.453	.943	-1.107
SHIFTEVE	0-1	.090	.287	2.873	6.235
SHIFTNGH	0-1	.070	.256	3.381	9.397

[9]The two variables were added to the model in figure 9 as $\eta_{11\text{-}15}$ and $\eta_{16\text{-}18}$.

Figure 9. Phase Three of Model Development: The stage before final adjustment.



*all possible covariances permitted

The diagonal elements of the Θ matrix were assigned additional error variances as follows.

Variable	Error Variance	Rationale
CLIN2	1%	To allow for any error in either initial coding or recoding
CLIN3	1%	"
CLIN4	1%	"
CLIN5	1%	"
CLIN6	1%	"
SHIFTDAY	2%	To allow for any error in either initial coding or recoding
SHIFTEVE	2%	"
SHIFTNGH	2%	"

The run with these eight variables added to the model in figure 9 resulted in: χ^2=60.72, *df*=44, p=.048, and AGF=.910.[10] Neither of these sets of concepts exerted a statistically significant influence on research utilization as indicated by their t-values; and I determined that they were not relevant to ongoing model development at this point.

What did this model (see figure 9) suggest to me at this juncture? First, it suggested that once again, most of these concepts exert no direct effect on research utilization, with the possible exception of RINSERV. Second, the nature of any connections to direct, indirect and persuasive (η_5, η_6 and η_7) research utilization are unclear. None are suggested in the output from the various runs. It is likely that any indirect effects (i.e., through η_5, η_6 or η_7) have again been camouflaged within the covariances among the background concepts. I was left then with the notion that direct, indirect and persuasive research utilization continue to remain strong predictors of overall research utilization. Additionally, I might have a few additional predictors, but certainly not the larger set I had envisioned. The only way remaining variables would function in the model would be through η_5, η_6 and η_7.

Locating the Final Model

The final stage of constructing and assessing model 3 (which was to be the final research utilization model pertaining to the individual practitioner) was then undertaken.

[10]Sample size for this run was 275.

At this point I reintroduced concepts that I had dropped from the modeling exercise in phases two and three because their t-values had not reached an absolute value of two. The concepts that I reintroduced were: job satisfaction (JOBSAT), research or statistics courses taken (RCOURSES), hours per week presently worked (HRWKPRES), attitude to research (ATTITUDE), professional autonomy (AUTONOMY), and professional and civic activism (ACTIVISM). I reintroduced courses taken and attitude to research because the nursing literature so strongly suggests these two as predictive of research utilization. I reintroduced autonomy because there is a strong implicit bias for it in both nursing and non-nursing literature and I believe autonomy should influence research utilization. So, although its direction was unexpected in the modeling thus far (higher levels of autonomy being associated with less research use) I was unwilling to abandon it. I reintroduced job satisfaction, hours per week presently worked and activism because I believe strongly that they likely exert an influence. So, again although one of the concepts (HRWKPRES) was exerting an influence in an unexpected direction, I retained it because of the implications of its influence (i.e., working more resulting in less research use would present a challenging situation).

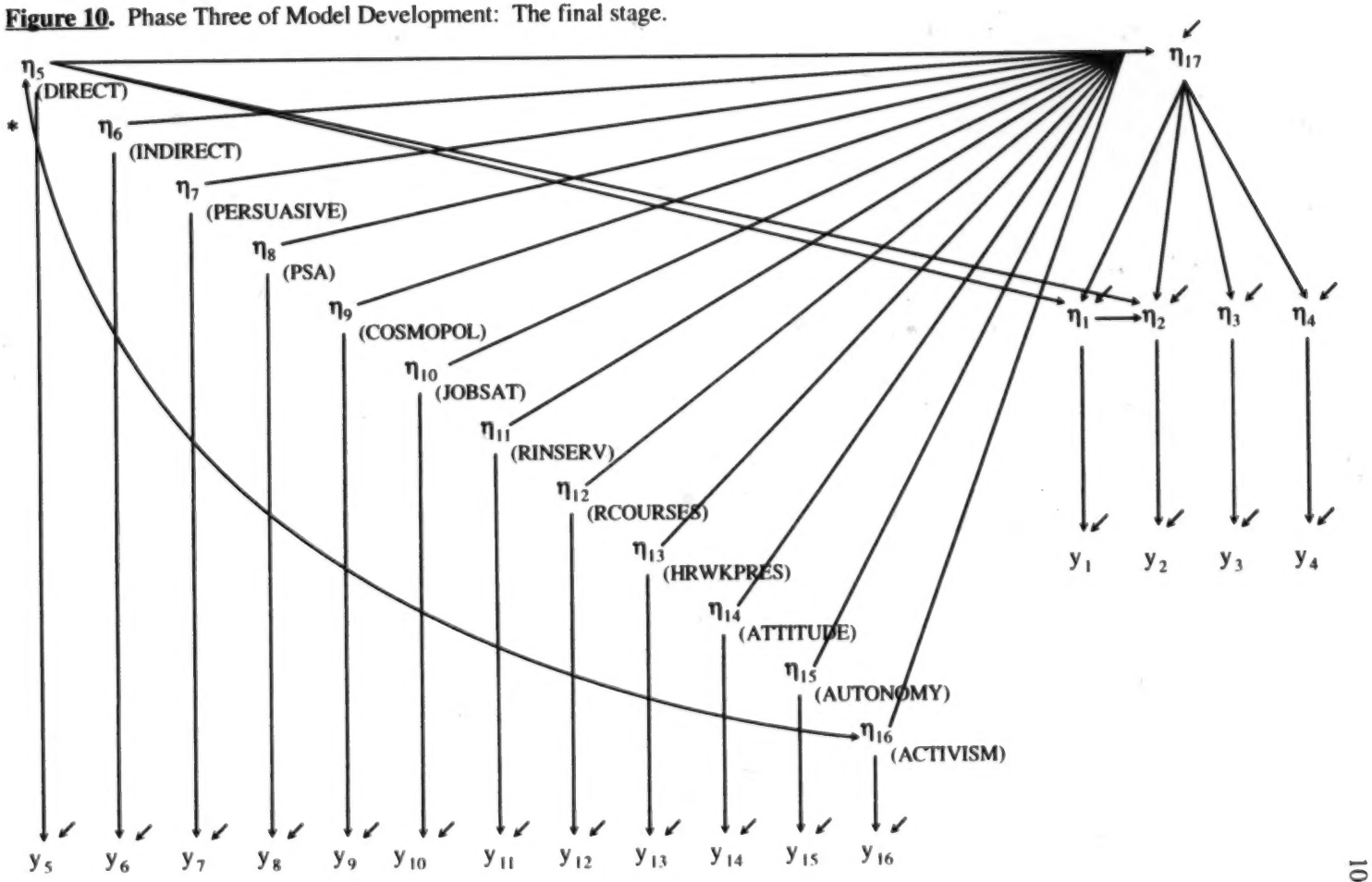
The model assessed at this juncture has *real research utilization* (REALRU) as η_{17} and is represented in figure 10. Specification and estimation of this model resulted in: χ^2=37.52, *df*=35, p=.354, and AGF=.935.[11] The t-values[12] for the beta coefficients in this model were:

BE(2,1)	BE(1,5)	BE(2,5)	BE(17,5)	BE(17,6)
7.248	1.812	4.683	8.854	4.767
BE(17,7)	BE(17,8)	BE(17,9)	BE(17,10)	BE(17,11)
2.085	2.100	2.456	2.106	2.138
BE(17,12)	BE(17,13)	BE(17,14)	BE(17,15)	BE(17,16)
2.089	-1.451	1.581	-1.156	1.846
BE(1,17)	BE(2,17)	BE(3,17)	BE(4,17)	
7.466	2.991	12.825	12.741	

[11]Sample size for this run was 270.

[12]Only t-values ≥ ±2 are considered statistically significant.

Figure 10. Phase Three of Model Development: The final stage.



*all possible covariances permitted

The explained variances for the concepts in this model remained high at[13]:

RUO#1	RUO#2	RUO#3	RUO#4	DIRECT
(η_1)	(η_2)	(η_3)	(η_4)	(η_5)
.576	.710	.800	.800	.000
INDIR	PERSUA	PSA	COSMOPOL	JOBSAT
(η_6)	(η_7)	(η_8)	(η_9)	(η_{10})
.000	.000	.000	.000	.000
RINSERV	RCOURSES	HRWKPRES	ATTITUDE	AUTONOMY
(η_{11})	(η_{12})	(η_{13})	(η_{14})	(η_{15})
.000	.000	.000	.000	.000
ACTIVISM	REALRU			
(η_{16})	(η_{17})			
.000	.777			

The standardized residuals contained six values greater than an absolute value of two but no discernable pattern of ill fit. The following illustrates the location of ill fit that was demonstrated in the standardized residuals:

RUDIRECT & RUO#1	2.243
RUO#4 & RUO#3	2.932
COSMOPOL & RUO#3	-2.332
RINSERV & RUO#2	2.373
HRWKPRES & RUO#4	-2.144
RINSERV & RUDIRECT	-2.337

This was assessed as a (minimally) acceptably fitting model; it fell somewhat short, as had the previous model, of the rather stringent criteria of $p \geq .75$ (.354) and $AGF \geq .96$ (.935). Further this model suggested that concepts such as job satisfaction, inservices attended and research/stats courses taken may influence research use. Problem solving ability and cosmopoliteness remained in the model as influencing research use. The integrity of the "core model" remained generally intact.[14]

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[13]The actual variance in REALRU, the unmeasured concept was 4.489.

[14]The residuals suggest that the "core model" is, at this juncture not entirely problem free, with some problems fitting the covariance matrix among the four multiple indicators (η_1 to η_4).

Summary

The final model depicted in figure 10 forms a model of *Factors Influencing Research Utilization* constructed from the best available indications in the literature and in the investigator's experience; and secondarily from data implications. It is referred to during the reminder of the chapters as *Model 3*. The final version of model 3 which demonstrates borderline fit, was arrived at after seven steps which have been outlined and which incorporated one major set of theoretical modifications--the elimination of all but four of the 22 concepts added in this phase. I arrived at a model which asserts that: (1) direct, indirect, and persuasive research utilization remain as strong predictors of research utilization, even with a new set of concepts, (2) problem solving ability and cosmopoliteness continue as influencing research utilization, (3) job satisfaction, inservices attended, research/stats courses taken, and hours per week worked may influence research utilization and, (4) whatever other effects any remaining concepts exert, they must work indirectly on research utilization through direct, indirect, and persuasive research utilization. The theoretical implications of this final model are quite significant and if born out in the validation and combination phases of modeling will run counter to a significant proportion of the nursing literature in the field, as well as, presenting new insights.

Chapter 8

Split-Half Validation and a Combined Model

To assess whether I had capitalized on chance sampling fluctuations when making model modifications, particularly those made in the core model described in chapter five, the reserved half of the data (rusplit2) was now brought forth and the final model in figure 10 of the previous chapter, assessed with this data set. In the first part of this chapter this validation process is described, following much the same format as the previous three chapters. In part two, the final results of repeating the analysis of chapters six through seven on the second half of the data set are described to address the issue of sampling fluctuations and their impact on retention of concepts. In the third part of this chapter the results of running the model in figure 10 on the entire data set (with no random division) are reported.

Part I: Validation with the Second Half of the Data

Using the other half of the data with the model constructed at the end of chapter seven (figure 10), I now began the task of validating that model. While the model remains the same, the univariate statistics for the indicators and the covariance matrix are different, consistent with the different values in the second half of the data.

Univariate Summary Statistics for the Indicators

The statistics describing the 16 concepts used in this validation assessment, are from the *second* randomly split half of the data (rusplit2) presented in table 7.

The Covariance Matrix

The covariance matrix for this validation model was created using pairwise deletion of missing cases. This resulted in an average sample size ranging from 187 to 300 out of a total sample size of 300. Again average sample size was used to run the LISREL program. In this case the average sample size was 270. Missing values for the pairs of variables ranged from 0 to 37.67%. A listwise deletion would have resulted in only 151 useable cases with which to do the validation assessment. The covariance matrix used for this run is found in appendix F.

Table 7. Statistics for the Indicators in the Validation Run.

Indicator	Range	Mean	Std Dev	Skewness	Kurtosis
RUO#1 (y_1)	1-7	4.163	1.917	0.017	-1.168
RUO#2 (y_2)	1-7	4.730	1.839	-.278	-1.029
RUO#3 (y_3)	1-7	4.796	1.855	-.330	-1.074
RUO#4 (y_4)	1-7	4.704	1.762	-.298	-.969
RUDIRECT (y_5)	1-7	4.588	1.928	-.236	-1.143
RUINDIR (y_6)	1-7	5.185	1.753	-.722	-.507
RUPERSUA (y_7)	1-7	3.460	1.749	.482	-.827
PSA (y_8)	29-60	46.572	5.388	-.192	.148
COSMOPOL (y_9)	2-34	12.430	5.919	.931	1.224
JOBSAT (y_{10})	1-5	3.591	1.048	-.428	-.375
RINSERV (y_{11})	0-13	4.274	3.491	.961	.067
RCOURSES (y_{12})	0-4	.617	.916	1.333	1.001
HRWKPRES (y_{13})	0-78	28.163	12.188	.123	.594
ATTITUDE (y_{14})	8-30	24.324	3.181	-.541	1.649
AUTONOMY (y_{15})	23-50	40.113	4.917	-.358	.162
ACTIVISM (y_{16})	0-26	15.309	4.236	-.781	1.672

The Validation Run

Estimates of the model in figure 10 were again obtained using MLE and model fit was assessed by examining χ^2, AGF, the standardized residuals, and other parameters. Estimation of the model in figure 10 using the covariance matrix constructed from the second half of the data[1] resulted in: χ^2=37.52, *df*=35, p=.390, and AGF=.936. The t-values for the beta coefficients in this model are shown in table 8. Comparing the t-values for the two model runs, there were two effects that were significant in the first but not second half of data, and three effects that were significant in the second but not first half of data. I will return to considering this shortly.

[1]Because the variances in the second half of the data were slightly different, new theta epsilon (TE) values were required. These were calculated using the same percent error as had been used previously for each indicator in figure 10.

Table 8. T-values and unstandardized structural coefficients for First and Validation Runs[2]

Effect	First Run (rusplit1)		Validation Run (rusplit2)	
Effects going to research utilization	coefficient	t-value	coefficient	t-value
BE(17,5)	.623	8.854	.429	8.655
BE(17,6)	.263	4.767	.146	3.014
BE(17,7)	.106	2.085	.265	5.560
BE(17,8)*	.034	2.100	-.028	-1.637
BE(17,9)*	.034	2.456	-.009	-.745
BE(17,10)*	.155	2.106	.058	.819
BE(17,11)	.049	2.138	.049	2.129
BE(17,12)*	.164	2.089	-.018	-.216
BE(17,13)	-.011	-1.451	-.010	-1.548
BE(17,14)**	.052	1.581	.166	4.207
BE(17,15)	-.022	-1.156	-.001	-.082
BE(17,16)	.031	1.846	-.005	-.293
Effects going to multiple indicators				
BE(1,17)	.574	7.466	.654	8.512
BE(2,17)	.205	2.991	.332	4.301
BE(3,17)	.740	12.825	1.038	16.086
BE(4,17)	.729	12.741	.897	15.349
Other effects				
BE(2,1)	.387	7.248	.370	6.415
BE(1,5)**	.147	1.812	.170	2.736
BE(2,5)	.282	4.683	.198	3.709

* t-value significant in first but not second half of data
** t-value significant in second but not first half of data

[2]Both runs (the first and the validation run) were done using the indicators in figure 10 of chapter seven, where η_{17} is (real) research utilization.

The standardized residuals contained only three values greater than an absolute value of two in the validation run. Those covariance mismatches were: RUPERSUA & RUO#1 (-2.668), RINSERV & RUO#1 (2.091), RINSERV & RUDIRECT (-2.062). Of these three covariances only RINSERV & RUDIRECT were also in the six covariances of the final model in the previous chapter with values greater than an absolute value of two. In that run the standardized residual for RINSERV & RUDIRECT was -2.337.

The explained variances for the concepts in this validation model remain persistently high and are shown below[3]. Those values in square brackets are the explained variances from the run using the first half of the data (rusplit1).

RUO#1	RUO#2	RUO#3	RUO#4	DIRECT
(η_1)	(η_2)	(η_3)	(η_4)	(η_5)
.524	.618	.894	.772	.000
[.576]	[.710]	[.800]	[.800]	[.000]

INDIR	PERSUA	PSA	COSMOPOL	JOBSAT
(η_6)	(η_7)	(η_8)	(η_9)	(η_{10})
.000	.000	.000	.000	.000
[.000]	[.000]	[.000]	[.000]	[.000]

RINSERV	RCOURSES	HRWKPRES	ATTITUDE	AUTONOMY
(η_{11})	(η_{12})	(η_{13})	(η_{14})	(η_{15})
.000	.000	.000	.000	.000
[.000]	[.000]	[.000]	[.000]	[.000]

ACTIVISM	REALRU
(η_{16})	(η_{17})
.000	.647
[.000]	[.777]

This validation run was assessed as a minimally acceptably fitting model although falling short, as had the final model in the previous chapter, of the stringent fit criteria of $p \geq .75$ (.390) and $AGF \geq .96$ (.936). Most importantly, the integrity of the "core model" remained intact in the validation mode. The explained variance in real research utilization (REALRU) dropped from .777 in the first run to .647 in the validation run.

In comparing the coefficient estimates for the model in figure 10 that was estimated with first, the rusplit1 data and second, the rusplit2 data one finds that the coefficients were for the most part of the same general magnitude, and direction (see table 8). Discrepancies were noted in the direction of effects for the following concepts: activism, research/stats courses taken, job satisfaction, and hours per week presently worked. In the model assessed using the first half of the data the effect from each of these four concepts to the concept (REALRU) was positive. In the model assessed using

[3]The actual variance of REALRU in the validation run was 2.830.

the second half of the data the effects from each of these was negative. The presence of these discrepancies was worrisome, pointing to potential capitalizations on chance sampling fluctuations. Although there are some discrepancies between the two sets of estimates in direction of effects and significant effects, I was generally satisfied that the final model in figure 10 fit both sets of data reasonably well.

Part II: Re-estimating the Models--the Impact on Concept Retention

Prior to proceeding to the last step of analysis (running a finally arrived at model on the entire data set (n=600), I elected to repeat the steps of chapters six and seven on the second half of the data (rusplit2). I undertook this step to investigate whether I had failed to select concepts for inclusion in the final model that had been able to exert a statistically significant effect, but which had not because of sampling fluctuations. In this section I only report the end results of this process. That is, I do not go procedurally through each step of the process. The steps undertaken were a replication of those in chapters six and seven starting with the specification of a model where all effects were permitted from the concepts entered to the concept (REALRU).[4] Modeling results were generally similar to those of chapters six and seven in that no ill fitting models were encountered, nor were there other remarkable deviations in diagnostic information. There were, however, significant differences in concept retention.

The modeling here was done in two basic steps. First, the set of concepts discussed in chapter six was modeled. This resulted in a model with χ^2=53.30, *df*=47, p=.245, AGF=.916. When the t-values were examined, the concepts retained were professional affiliation (AFFILP), t=2.053, research belief (BELIEFT), t=4.070, and dogmatism (DOGMATSM), t=-2.779. In the run with the first half of the data, the concepts retained at this stage were problem solving ability (PSA) and cosmopoliteness (COSMOPOL). The negative direction of the dogmatism concept was expected. When the model was respecified including only these three concepts in addition to the seven in the core model the run resulted in: χ^2=15.94, *df*=17, p=.528, AGF=.963. All concepts in the model at this stage has t-values greater than an absolute value of two. As well, the standardized residuals revealed no pattern of ill fit with only one value greater than an absolute value of two.

In the second step of modeling at this stage, the set of concepts discussed in chapter seven was added to the final model from the paragraph above. This resulted in a model with χ^2=57.96, *df*=59, p=.514, AGF=.918. When the t-values were examined, the concepts retained were health and lifestyle activity (HLSA), t=-2.807, hours per week

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[4]As in chapters six and seven appropriate covariance matrices were obtained for each model using pairwise deletion of missing cases. The average sample size was calculated for each run based on the values for the concepts in that particular model. The univariate statistics for each indicator parallelled those reported in chapters six and seven.

presently worked (HRWKPRES), t=-2.253, and total dependant care hours (DCHX), t=2.295. In the run with the first half of the data, the concepts retained at this stage were hours per week presently worked (HRWKPRES) and number of inservices attended in the last year (RINSERV). The model, when respecified and rerun at this stage resulted in: χ^2=26.56, *df*=26, p=.433, AGF=.950 and with no pattern of ill fit in the standardized residuals. The t-values of the concepts that were in addition to the seven in the core model, at this juncture were: AFFILP (2.793), BELIEFT (5.802), DOGMATSM (-3.081), HLSA (-2.660), HRWKPRES (-1.876), DCHX (2.540). The direction of DCHX was unexpected.

The final model taken into the validation process discussed earlier in this chapter, specified four concepts that did not have significant t-values, but which were theoretically plausible. Those concepts were HRWKPRES, ATTITUDE, AUTONOMY, and ACTIVISM. Those same concepts were also retained in the final model in this stage. When this was done it resulted in a final model with: χ^2=34.26, *df*=35, p=.504, AGF=.942. All of the concepts added thus far, except these last four remained with significant t-values.

The final model arrived at using the first half of the data (the model in figure 10) contained the same number of concepts but five of these were different. It had resulted in: χ^2=37.52, *df*=35, p=.354, AGF=.935. The concepts in the two models are compared in table 9.

Table 9. A Comparison of Concepts Retained in the two Final Models Constructed with Different Halves of the Data (core model with concepts η_1 to η_7 assumed in both).

First Final Model (using rusplit1)	**Second Final Model (using rusplit2)**
PSA	AFFILP
COSMOPOL	BELIEFT
JOBSAT	DOGMATSM
RINSERV	HLSA
RCOURSES	DCHX
HRWKPRES	HRWKPRES
ATTITUDE	ATTITUDE
AUTONOMY	AUTONOMY
ACTIVISM	ACTIVISM

In these two models, none of the last four concepts (HRWKPRES, ATTITUDE, AUTONOMY, ACTIVISM) had t-values equal to or greater than an absolute value of two. This presented me with the question of whether to run a combined model using only those concepts with significant t-values in each run or with all of the concepts in table 9. I elected to run the combined model with all of the concepts in table 9. This approach would be a theoretically consistent one and would also point to any effects among these concepts that had not thus far reached significance because the sample size was not large enough to permit the detection of all significant effects.

Part III: The Combined Run

In this step the full data set (n=600) was used. This was done in order to assess the magnitude of the effects more accurately and in anticipation of obtaining more data on the usefulness of the concepts I retained because of their theoretical importance, and not necessarily their ability to reach statistical significance. This larger data set was also used to verify that the eight dummy variables eliminated in chapter seven truly do not exert significant effects. The model estimated in this stage is located in figure 11.

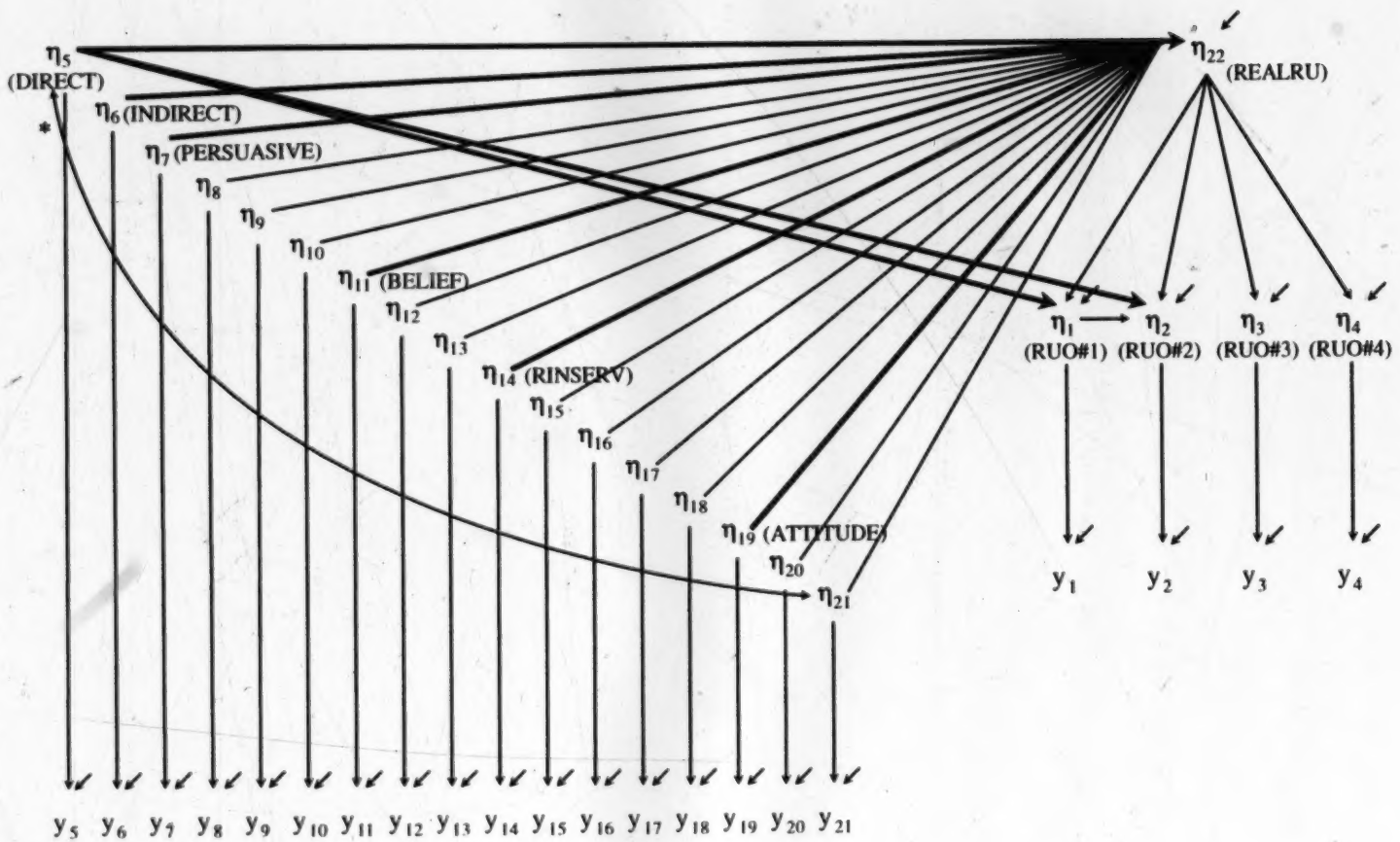
Univariate Summary Statistics for the Indicators

The statistics describing the 21 concepts used in this validation assessment, are presented in table 10. These statistics are from the *full* data set (ruwork).

The Covariance Matrix

The covariance matrix for this combined run was created using pairwise deletion of missing cases. This resulted in an average sample size ranging from 362 to 600 out of a total sample size of 600. Again average sample size was used to run the LISREL program. In this case the average sample size was 547. Missing values for the pairs of variables ranged from 0 to 39.67%. A listwise deletion would have resulted in only 274 useable cases with which to do the combined run. The covariance matrix used for this run is found in appendix G.

Figure 11. The Final Model of Factors Influencing Research Utilization.



*all possible covariances permitted

Table 10. Statistics for the Indicators in the Combined Run.

Indicator	Range	Mean	Std Dev	Skewness	Kurtosis
RUO#1 (y_1)	1-7	4.160	1.890	0.066	-1.153
RUO#2 (y_2)	1-7	4.693	1.839	-.238	-1.069
RUO#3 (y_3)	1-7	4.750	1.808	-.270	-1.083
RUO#4 (y_4)	1-7	4.666	1.766	-.271	-1.013
RUDIRECT (y_5)	1-7	4.474	1.917	-.128	-1.180
RUINDIR (y_6)	1-7	5.194	1.788	-.748	-.506
RUPERSUA (y_7)	1-7	3.531	1.756	.423	-.904
PSA (y_8)	29-60	46.940	5.398	-.163	.115
COSMOPOL (y_9)	0-39	12.479	6.138	1.006	1.498
AFFILP (y_{10})	0-1	.109	.312	2.517	4.326
BELIEFT (y_{11})	6-30	20.531	4.897	-.240	-.097
DOGMATSM (y_{12})	10-67	27.765	8.368	.513	.726
JOBSAT (y_{13})	1-5	3.546	1.084	-.506	-.367
RINSERV (y_{14})	0-13	4.545	3.652	.828	-.360
RCOURSES (y_{15})	0-4	.651	.979	1.359	1.037
HLSA (y_{16})	0-46	6.615	5.932	2.550	10.815
DCHX (y_{17})	0-9	1.917	1.880	1.236	1.407
HRWKPRES (y_{18})	0-78	28.140	11.857	-.052	.158
ATTITUDE (y_{19})	8-30	24.381	3.023	-.489	1.238
AUTONOMY (y_{20})	23-50	40.372	4.800	-.222	-.054
ACTIVISM (y_{21})	0-28	15.134	4.653	-.723	1.200

Model Estimation

Estimation of the model in figure 11 resulted in: χ^2=55.91, *df*=50, p=.263, AGF=.956. The standardized residuals showed nine values greater than an absolute value of two (-3.088 to 2.879) but no systematic pattern of ill fit. The combined t-values showed (in addition to the core model in which all values remained significant) that only BELIEFT (3.368) , RINSERV(2.880), and ATTITUDE (2.295) had remained significant. T-

values and unstandardized coefficient estimates for the three models are shown in table 11. As can be seen from this table, the coefficients were for the most part either of the same general magnitude and direction, or of a slightly smaller magnitude but of the same direction. The explained variances in this model in figure 11 were[5]:

RUO#1	RUO#2	RUO#3	RUO#4	DIRECT	INDIR
(η_1)	(η_2)	(η_3)	(η_4)	(η_5)	(η_6)
.545	.664	.843	.794	.000	.000
PERSUA	PSA	COSMOPOL	AFFILP	BELIEFT	DOGMATSM
(η_7)	(η_8)	(η_9)	(η_{10})	(η_{11})	(η_{12})
.000	.000	.000	.000	.000	.000
JOBSAT	RINSERV	RCOURSES	HLSA	DCHX	HRWKPRES
(η_{13})	(η_{14})	(η_{15})	(η_{16})	(η_{17})	(η_{18})
.000	.000	.000	.000	.000	.000
ATTITUDE	AUTONOMY	ACTIVISM	REALRU		
(η_{19})	(η_{20})	(η_{21})	(η_{22})		
.000	.000	.000	.703		

One final step was taken in the analysis before proceeding further. The final model just described was reassessed with the eight dummy variables that had been eliminated in chapter seven because there was an insufficient sample size with which to estimate that model. The variables CLIN2, CLIN3, CLIN4, CLIN5, CLIN6, SHIFTDAY, SHIFTEVE, and SHIFTNGH were added to the model as having direct effects on real research utilization and the model was re-estimated. The results of this run were a less well fitting model (χ^2=111.78, *df*=80, p=.011, AGF=.928). Explained variance remained essentially unchanged but the standardized residuals revealed greater ill fit with 87 values exceeding an absolute value of two (range -4.031 to 3.896). Most importantly none of the eight added concepts reached a t-value of greater than an absolute value of two (range -.860 to 1.823).[6] The t-values for the remaining concepts did not change appreciably from the final combined run reported above. None changed significance.

As a result of this run and the modeling exercises described in this chapter I concluded that there was a strong probability that I had not missed any concepts that were significant, and that I had ruled out concepts that were not truly significant either by demonstrating that they did not reach significant levels in any of the runs, or demonstrating that some concepts reached significant levels in some runs because of likely sampling fluctuations.

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[5]The actual variance in REALRU was 3.372.

[6]T-values were: CLIN2 (1.708), CLIN3 (1.427), CLIN4 (-.536), CLIN5 (1.823), CLIN6 (.516), SHIFTDAY (-.044), SHIFTEVE (.029), and SHIFTNGH (-.860).

Table 11. T-values and Unstandardized Structural Coefficients for Runs with the First Half, Second Half and Combined Data

Effect	First Run (rusplit1)		Second Run (rusplit2)		Combined Run (ruwork.sav)	
Effects going to research utilization	coefficient	t-value	coefficient	t-value	coefficient	t-value
DIRECT	.623	8.854	.498	9.258	.495	12.473
INDIRECT	.263	4.767	.167	3.274	.218	6.007
PERSUASIVE	.106	2.085	.259	5.349	.160	4.644
PSA	.034	2.100	-----	-----	.002	.134
COSMOPOL	.034	2.456	-----	-----	.009	1.012
AFFILP	-----	-----	.690	2.635	.215	1.285
BELIEFT	-----	-----	.092	4.879	.044	3.368
DOGMATSM	-----	-----	-.027	-2.989	-.011	-1.713
JOBSAT	.155	2.106	-----	-----	.079	1.605
RINSERV	.049	2.138	-----	-----	.047	2.880
RCOURSES	.164	2.089	-----	-----	.070	1.256
HLSA	-----	-----	-.037	-2.475	-.014	-1.425
DCHX	-----	-----	.114	-2.989	.034	1.034
HRWKPRES	-.011	-1.451	-.010	-1.470	-.009	-1.836
ATTITUDE	.052	1.581	.030	1.106	.051	2.295
AUTONOMY	-.022	-1.156	-.016	-1.005	-.013	-1.064
ACTIVISM	.031	1.846	-.003	-.151	.016	1.335
Effects going to multiple indicators						
RUO#1 fr REALRU	.574	7.466	.590	8.507	.618	11.319
RUO#2 fr REALRU	.205	2.991	.310	4.498	.283	5.468
RUO#3 fr REALRU	.740	12.825	.923	15.248	.900	20.987
RUO#4 fr REALRU	.729	12.741	.812	14.770	.836	20.553
Other effects						
RUO#1 to RUO#2	.387	7.248	.365	6.391	.378	9.715
DIRECT to RUO#1	.147	1.812	.167	2.717	.168	3.442
DIRECT to RUO#2	.282	4.683	.192	3.637	.228	5.815

Summary

The model depicted in figure 11 forms what I consider to be the final model of *Factors Influencing Research Utilization* constructed for this dissertation. It was developed from the best available indications in the literature and in the investigator's experience; and from data implications in addition to those of chapter seven. This final model was arrived at after careful consideration to sampling fluctuations and results in a determination that only three of a total of 25 concepts added during these combined modeling exercises remain in the model as exerting a significant effect on the dependent variable, real or actual research utilization (REALRU). This model continues to assert that: (1) direct, indirect, and persuasive research utilization remain as strong predictors of research utilization, controlling for the other variables, and also implicitly controlling for all the excluded variables, (2) inservices attended in the past year, belief,[7] and attitude to research exert direct effects on real research utilization, and (3) whatever other effects any remaining concepts exert, they must work indirectly on research utilization through either direct, indirect, and persuasive research utilization or through attitude, belief, and inservices attended. While the number of concepts that "fell out" of the modeling exercises was discouraging, and strongly suggests that (a) my original theorizing was lacking specific to the influence of individual variables, and (b) the literature in this area is at best tentative, I am confident that the results are valid. The theoretical implications of this final model are significant and offer new insights into the causal mechanisms of research utilization. Those implications are discussed in chapter nine.

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[7]This concept is discussed at some length in chapter 9. Because I encountered difficulty in clarifying the meaning of this concept when using its original label (belief), in that chapter a more descriptive label is assigned to it.

Chapter 9

Discussion

Thus far in this dissertation the reader has been presented with a discussion of the theoretical underpinnings of the field of research utilization in nursing, a description of the study methods and a detailed description of the analytic process that led eventually to the final model--figure 11 in chapter eight. In this final chapter I will attempt to consolidate what I believe are the critical elements of this study into a coherent discussion that is accessible to a wider audience than the previous four chapters may have been. I will discuss two main areas--the study itself and the field of research utilization more generally. The former constitutes the major contribution of this chapter; specifically included are: limitations to the study, discussion of the major findings, and implications of those findings. The second area includes my thoughts on the immediate and long-term future in this area.

Limitations

The majority of this study's potential limitations fall within three categories. First, this study was substantially premised on work outside of nursing. While many important advantages are to be realized by crossing disciplinary boundaries, it may be that some of the concepts chosen for inclusion in the modeling exercises were context or discipline specific. If this were so, any concepts with that characteristic would, in all likelihood, not function as expected in nursing. I identified only one concept, theoretical orientation which is discussed later in the chapter, where I believe this may have been the case, but there could be others.

The second potential limitation in this study is a low response rate (40.67%). While this response rate compares favourably with other mail surveys conducted with the general practising nurse population (see chapter four, page 55), and while I was delighted with such a good response rate given the volatile health care restructuring underway in the province, it does introduce the possibility of a response bias. Did one or more groups within the 1500 nurses receiving the survey systematically respond or not respond? In examining the available data comparing the study sample with the population I did not detect a systematic response bias in the study. From table 2 (page 56) it can be seen that the sample contained slightly more baccalaureate prepared nurses (25.2% vs. 19.8%),

slightly fewer diploma prepared nurses (70.8% vs. 79.7%), somewhat fewer hospital nurses (41.8% vs. 51.9%), somewhat more geriatric and long term care nurses (18.3% vs. 12.05%), and somewhat more public health nurses (9.3% vs. 4.8%). Unfortunately the data in table 3 (page 57) from the sample is not available on the population of practising nurses. While it is probable that the findings from this study are generalizable to the population of practising nurses in Alberta, given the 40% response rate, caution must still be exercised in making such generalizations.

The third potential limitation in this study is the use of a newly developed data collection instrument (the Research Utilization Questionnaire) on which there is very limited prior evidence attesting to its validity and reliability. This will raise the question among some, of the integrity of the measurement in this study. Specifically, did some concepts "fall out" of the modeling exercises because the instrument was not sensitive enough? Before addressing the individual concepts that did not remain in the model, or did not remain in the model as significant it is useful to look at the "core model" in this study. The core model is that model described in chapter five, and illustrated in figure 5 (page 73). This model which incorporates the unmeasured concept, (real) research utilization, four indicators of research utilization, and three predictors of research utilization, demonstrates construct validity as evidenced by its acceptable fit, and its high explained variances reported in chapters five through eight. This fit and the high explained variances persisted regardless of whether the first half, second half, or combined data sets were used to run the model, and despite the addition of a total of 25 additional concepts to the model, before the study was completed. Such demonstrated construct validity, that is, fit between data and theory when the estimates are constrained by both the model (theory) and the data, imply by definition that the instrument had the ability and sensitivity to measure the constructs under question.

This existing validity in the measurement structure of the core model is not surprising; its concepts were measured using section one of the questionnaire on which I spent proportionately the greatest time and care, and which was revised most heavily following the pilot study. Conceptually I was clear about how best to measure research utilization within the context of a self-report survey, and how to make the best use, given the available literature, of examples to strengthen my intended meanings of these concepts. In the remainder of the questionnaire I did not always have such assurance about conceptualizations, and the literature was sometimes very limited in its ability to provide direction.

In examining the individual concepts in this study that either did not reach the final modeling stage in figure 11, or reaching that stage did not exert significant effects, I cannot turn as assuredly to model fit as evidence that the instrument has validity. While the models in chapters six through eight generally fit the data, they did not come as close to reaching the predetermined model fit criteria ($p \geq .75$ and $AGF \geq .96$) as would have been hoped. However, in response to the question of "did some individual factors fall out

of the modeling exercises because of instrument fallibility?" the following response can be made:

> Let us assume that any one of the questions attempting to measure its corresponding indicator is not a good measure. Further, let us make it such a poor measure that we are compelled to assign *20% error variance* to the indicator (instead of the 5%, 10%, or as was most often the case in the modeling done in previous chapters 1 or 2% error variance), an assignment that so loosens the indicator's connection to the concept that some might argue they have little in common. Then, let us re-run the model with the same data. If the model continues to perform well, offering the same or near same indices of fit and estimated coefficients, we would be convinced that it did not matter that our measurement was not perfect because even if we deliberately make it grossly imperfect, the model still performs at least as well.

In fact, using the final determined model (figure 11) in this study, each of the 14 individual indicators for the concepts PSA through ACTIVISM (η_8 to η_{21}) were assigned 20% error variance (one at a time) and the model re-run to determine if it performed consistently. In each case[1] nearly identical coefficients[2] were obtained and in all cases the exact same model fit parameters were achieved. Despite serious infringements on the integrity of the relationships between the concepts and their respective indicators, the model performed as well as it did under my preferred specifications.

Instrument validity is of course never established for all time, however, strong evidence does exist in this study to support the ongoing use of this survey to measure overall research utilization and its sub-types. In this way additional evidence to support or not support the instruments' validity will begin to accrue. Sufficient evidence exists to also encourage additional use of the instrument to measure individual concepts that may influence research utilization. However, prior to such measurement additional work on the measures used in this study is warranted; this additional work is discussed later in the chapter.

Major Findings

There were two major sets of findings in this study, the first are about what has been called throughout this report, the "core model", the second are about the individual and professional factors that may influence research utilization. Each of these is

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[1]Different start values had to be assigned in several cases to achieve a converging run. These ranged from 0.1 to 1.5 for the diagonal elements of the ψ matrices, and the β effects.

[2]Individual coefficient estimates did not vary more than 5% in the runs with 20% error variance, compared to the combined run with their original error variance assignments which varied from 1% to 10%.

discussed in turn in the following sections with implications accompanying each set of findings.

The "Core Model"

I believe the most important finding in this study is the development and testing of the model I have called *The Formal Structure of Research Utilization* pictured in figure 5. Its importance lies in several areas. First, I have not located any published or unpublished reports where a causal and formal structure of research utilization in nursing has been modeled. Second, the sub-types of research utilization, direct, indirect, and persuasive have not, to the best of my determination, been described[3] or measured in nursing. Third, research utilization was measured differently in this study. The approach used here is a simpler way to measure extent of research utilization than other means appearing in the literature. If it is found to be a valid approach in nursing it will greatly simplify our assessment of *extent*.

A Common Cause and a Simplex Model of Research Utilization

At the end of chapter five I wrote:

> The theoretical implications of living with a factor instead of a simplex model are important. This factor or "common cause" model asserts that: (1) there is an actual real condition--real research utilization--that exists, (2) it is influenced by unique "sub" kinds of research utilization (direct, indirect, persuasive), (3) nurses can reasonably report this real research utilization, and (4) we can measure it. Further, it may be possible to measure both real research utilization and the other kinds of research utilization, with single "proxy like" questions, thus avoiding complex and detailed measures that have been employed in the past to determine extent of research utilization.

What was not addressed in that chapter and elsewhere in only a limited manner, was the idea of formal structure. While we have many models of research utilization in nursing, most of them are reminiscent of what Ellis (circa 1984) called ideologies, the conceptual nursing models of the 1970s and 1980s. Neither the grand nursing theories or the large process models of research utilization are directly testable. Of greater use in developing the scientific basis of research utilization are testable mid-range theories. Such theory demands a direct connection between the theoretical and the empirical world and a significant degree of commitment from its proponent. In this study, the unforgiving mathematical implications of the simplex model, which were inconsistent with the data, forced me to abandon the simplex model of research utilization with which I had started

[3]With the notable exception of Stetler's (1994b) theoretical treatment.

the study, and from which I had conceptualized and operationalized a particular temporal ordering in the data collection instrument. This is the nature of the action required when working with formal theory. Sometimes the abandonment of one's original thinking is not difficult, as was the case in this study because an equally plausible and theoretically meaningful alternative was found in the common cause model. Sometimes the mathematical implications of the data are less palatable as occurred when I attempted to model individual factors and which I will discuss presently. However, both alternatives force a commitment to a theoretical position that has some grounding in the data. If I have learned any single lesson from this study it is the symmetry and the tyranny of "a model implies a sigma." If you draw a model as representative of your "theory", if you represent that model with a series of structural equations which have a series of specific mathematical implications, and then if you test that model against a data set containing indicators reflective of your concepts, you are mercilessly led to either defending your theory with the data as evidence, or to modifying your theory with the data as evidence.

The Sub-Types of Research Utilization

While a number of social scientists have described instrumental, conceptual and symbolic research utilization (Beyer & Trice, 1982; Huberman, 1987; Weiss, 1979, 1980) and while some have undertaken empirical work (Knorr, 1977; Rich, 1977; Sunesson & Nilsson, 1988; Weiss & Bucuvalas, 1980b) it has been almost exclusively in the policy context. Such work has not been conducted in nursing with the exception of Stetler's theoretical work (1994a, 1994b) in which she draws upon the social science and policy sources mentioned. In this study I used the words direct, indirect, and persuasive to refer to instrumental, conceptual, and symbolic research utilization respectively. These words seem to me to be more readily understood, and less cumbersome for both the researcher and the practitioner. I had no indication that the respondents had difficulty differentiating between direct, indirect, and persuasive research utilization. The results of the study showed that these three sub-types explain high amounts of the variance in the primary dependent variable--(real) research utilization, and that this effect was persistent across several different modeling exercises and with three different versions of the data set. It is with some confidence then, that I claim that these three sub-types of research utilization exist, that they can be measured, that each varies in extent of use, and the nurses' extent of use of these sub-types influences his or her overall use of research. Historically, in nursing when research use has been measured, only direct or instrumental use has been measured. It may be that reportedly low research use[4] is in part due to our failure thus far to measure all of the concept. Additionally, it seems likely that significant kinds of research use (i.e., indirect/conceptual and persuasive/symbolic) are being overlooked at all levels of interest in the profession.

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[4]As was discussed in chapter two, the persistent claim in the nursing literature that nurses do not use research is unfounded. If based on research studies at all, and it is doubtful that it is, those studies are not sufficient in number or scope to warrant such claims.

Implications of the "Core Model" Findings

A number of implications can be drawn from this set of findings. First, there is an underlying and measurable research utilization concept whose meaning is broad and includes the three sub-types of utilization--direct, indirect, and persuasive. The existence of such an "overall" concept has not been addressed by researchers in nursing who have looked only at direct (instrumental) utilization. Neither has it been addressed by nurses writing more generally about research utilization in nursing who have also primarily considered only direct research utilization. Additionally, it is possible to "tap" into this existing underlying state by use of a single "proxy" measure such as the single question that was used to measure overall research utilization in this study.[5]

Second, the existence of the three sub-types of research utilization, direct, indirect, and persuasive, is an important addition to researchers and to those planning strategies to increase research utilization and improve patient outcomes. Researchers can now begin to explore these types both individually and collectively. Individual exploration will result in a deeper understanding of their function, of unique causes of each, and of what effects each has on overall use, and on patient and system outcomes. Collective exploration will begin to increase our awareness of the inter-relatedness of these three sub-types with each other, with overall utilization, and with other concepts that function in a research utilization causal network. Presently, strategies to increase the use of research have been directed primarily toward increasing instrumental use. If the other two types of research utilization explain significant proportions of variance in overall research utilization, and if overall utilization is shown to have an effect on outcomes that is greater or different from that of instrumental use, then it is clear that attention to strategies that will enhance indirect (conceptual) and persuasive (symbolic) use are important and need to be developed and tested.

The third implication is related to the first, but is more directly about the issue of measuring research "use" or extent of research utilization. The approach to measuring research use taken in this study differs significantly from the prevalent approaches in nursing to date. It raises the question of what do we mean by *use*? The prevalent notion in the literature that nurses do not use research enough, suggests that there is some "gold standard" by which we measure enough. Yet none has been identified. I propose that we really have no idea what would be enough research use by nurses, but that we do believe that more is better. Further, I am suggesting that we are at an extremely rudimentary stage of understanding how to constitute use. Existing work such as that of Brett (1987) has taken the approach that we can systematically evaluate the body of nursing research and determine what findings are scientifically valid and ready for use. We can then ask

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[5]The reader will recall that this question was asked four times in the survey questionnaire in appendix A; three times in section one and a final time at the end of the questionnaire.

nurses to tell us on a likert like scale how much they use these findings, and sum their scores to reach a valid measure of use. Several troublesome elements in this approach are immediately apparent: it addresses only the use of *nursing* research, in its present form it cannot possibly keep pace with the explosion of nursing and other relevant research being conducted,[6] and it and other approaches in the nursing research utilization literature imply that the only valid form of evidence is research evidence. Alternatively the approach I have taken suggests that we can ask nurses a few specific and directed questions about their use of research, and their answers will be valid and reliable indicators of what we would find using more sophisticated approaches. Additionally, their answers need not be restricted to nursing research and we can incorporate additional questions about other sources of evidence that nurses use to guide their practice with little additional respondent burden.

The Role of Individual and professional Factors in Predicting Research Use

The second set of major findings in this study are those describing my attempts at modeling individual and professional factors as predictive of research utilization. At the end of chapter eight I wrote:

> This final model [figure 11] was arrived at after careful consideration to sampling fluctuations and results in a determination that only three of a total of 25 concepts added during these combined modeling exercises remain in the model as exerting a significant effect on the dependent variable, real or actual research utilization (REALRU). This model continues to assert that: (1) direct, indirect, and persuasive research utilization remain as strong predictors of research utilization, controlling for the other variables, and also implicitly controlling for all the excluded variables, (2) inservices attended in the past year, belief, and attitude to research exert direct effects on real research utilization, and (3) whatever other effects any remaining concepts exert, they must work indirectly on research utilization through either direct, indirect, and persuasive research utilization or through attitude, belief, and inservices attended.

Retaining only three of 25 concepts is not a resounding success if one is measuring success by the accuracy of my original "guesses". Nevertheless, important insights were achieved as a result of those modeling exercises in chapters six through eight. In this section, I will first discuss the concepts that were not retained as significant. Then I will discuss the three concepts that were retained in the model as exerting a significant direct

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[6]To date in nursing there has been little recognition in research utilization studies of the growing and important sources of research information found in databases such as the Cochrane database of systematic reviews and the Agency for Health Care Policy and Research (AHCPR). Hodnett et al. (1996) is a notable exception to this.

effect on research utilization. Finally, I will discuss the implications of this set of findings.

Background Concepts Entered into the SEMs

Of the 25 concepts[7] entered into the SEMs, 15 were background concepts (or in conventional LISREL nomenclature, exogenous concepts). These background concepts were described in chapters seven and eight. Of the concepts not retained, four of the 15 background concepts--age, sex, income, and marital/partner status--were only entered to control for their effects[8] and as expected they exerted no direct effects. Additionally, it was not unexpected that 'years since last education' and 'years worked' were not significant since they would usually be correlated with age. Education also not unexpectedly failed to reach significance. This would be consistent with most of the research done to date in this area. The only study to effectively demonstrate that education[9] exerts an effect was one in which the sample was such that nearly one half of the subjects had master's degrees in nursing (Michel & Sneed, 1995) and held predominately clinical nurse specialist positions.

In a second grouping of non-significant concepts were: job satisfaction, hours worked per week, dependent care hours, and health and lifestyle activity. That 'job satisfaction' was not significant was perhaps unexpected because it makes intuitive sense and could be construed as carrying some of the effects of organizational climate which are known to be important to research use. However, there is not much support for this concept influencing research utilization in the nursing literature (Coyle & Sokop, 1990). 'Hours worked per week', 'dependent care hours', and 'health and lifestyle activity' all measure some component of the time constraints or availability that nurses may experience. I thought that as 'hours worked per week' increased research use would increase because of increased opportunity to use research. In fact, it was not significant, *and* its effect was in the opposite direction--the more hours worked the less likely a nurse was to use research. The mechanism of this influence is not clear and may be a function of numerous other factors in the work setting. I reasoned that as the number of hours committed to caring for dependent children or adults increased that research utilization would decrease. While this was the direction of influence, its effect was very small and not significant. Correspondingly, as the number of hours spent in health and lifestyle

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[7]Twenty-five concepts were entered in total, although if one counted each of the dummy variables from the shift and clinical variables the total would be 33 not 25.

[8]Effects are "controlled" for in LISREL when despite their being entered into the equations, they (expectedly) do not demonstrate any statistically significant effects.

[9]Operationalized in the literature and in this study as highest level of formal nursing education achieved.

pursuits increased, I expected a decrease in research utilization. Not only was the effect negligibly small but it was in the opposite direction. These attempts at identifying some of the elements of time that exert an influence on research utilization were not successful. While lack of time during work hours has often been cited as a barrier to research utilization, other aspects of time have not been studied in nursing. Support for some of these other aspects of time was not found in these findings.

That the number of research and/or statistics courses taken failed to exert a significant influence on research utilization was surprising in light of the findings of Mohr (1969) and Rizutto et al. (1994). It is not likely that this concept was poorly measured in this study. The failure of 'research and/or statistics courses taken' to exert a significant influence may be because it does not exert an influence in this population. This sample is more representative of the educational level of practising nurses than the one Rizutto et al. obtained. In their sample over 50% (vs. 31% in their general population of nurses) of the subjects had baccalaureate degrees, whereas in this study 25% (vs. 19% in the population) had baccalaureate degrees. Since their response rate was 29%, they may have been working with a response bias from nurses with baccalaureate degrees that mitigated in favour of the positive effect of courses taken on research use.

That 'shift worked' and 'clinical area' were not significant, while disappointing in terms of my speculations, was not surprising in light of the lack of evidence supporting them in the literature. I had expected that nurses on day shifts would use research more because of the adverse effects of evening, and especially night shifts. I had also expected differences in clinical area, suspecting that public health nurses and critical care nurses would be higher users of research; the former because of the higher educational requirements for public health nurses in the province, and the latter because of the critical and "up front" role new information and technology play in saving lives in those areas. However, a close examination of the full set of descriptive statistics on the grouping of nurses by clinical area suggested early in the study that they were not remarkably different on key variables.

Of the background concepts, only 'inservices attended in the last year' was retained as exerting a significant effect on research utilization. It is discussed later in the chapter with the other concepts which were retained as significant.

The Principle Individual Concepts

The remaining ten concepts entered into the SEMs were activism, affiliation, attitude, autonomy, belief, cosmopoliteness, dogmatism, problem solving ability (PSA), theoretical orientation, and trust. Their entry was discussed in chapters six and eight. Of these, belief and attitude were retained as significant and will be discussed later in this chapter. Of the remaining eight, theoretical orientation was mentioned earlier in the limitations section of this chapter as being a concept that I had brought "across

disciplinary borders" so to speak. It has proven itself a strong predictor of research use in psychology (Cohen et al., 1986; Morrow-Bradley & Elliott, 1986) and psychologists have continued to study the theoretical orientations of their members (Norcross, 1985; Vasco & Dryden, 1994). However, it did not display significance in this study. While I had hoped that the more a nurse was guided by a theoretical perspective, the greater her use of research would be, this effect was not demonstrated.

In psychology subjects were usually asked to describe themselves as having either a behaviourist (including cognitive) orientation or a dynamic orientation, with the behaviourist/cognitively oriented practitioners more likely to use research. It is possible that the elements at work with the psychologists were different than those I captured by asking the question, "To what extent is your nursing practice guided by a theoretical position? (Examples of theoretical positions include: hierarchy of needs, systems theory, self-care, body systems, adaptation, goal attainment, human becoming, general needs, person-environment interaction, etc.)." The example I provided, and in fact the positions they represent do not necessarily reflect the style of thinking that might be captured by a behaviourist or a dynamic perspective. Additionally, the average length of time in this sample since graduating from basic nursing school (18 years) suggests to me that these nurses may have had a different understanding of theoretical orientation than I intended. Most of them would not have had exposure to the theoretical positions I identified in my examples and may have extrapolated common sense meanings from the examples.

Affiliation and activism had very limited support in the literature and did not demonstrate significant effects in this study. I had expected that nurses more closely affiliated with the profession or a clinical speciality would use research more because of a stronger expectation to do so. I had expected that nurses with higher scores on the activism variable would use research persuasively to a greater extent consistent with their general life approach. While this was not borne out, it is possible that in subsequent analyses that an indirect effect for activism through persuasive utilization may be found.

Neither dogmatism or trust were shown to exert a significant effect. Similarly, neither autonomy or PSA demonstrated a significant effect on research utilization. I found the failure of these four concepts particularly puzzling and disappointing. There was some support in the literature for dogmatism (e.g., Jacoby, 1971; Mohr, 1969; Rogers, 1995) and PSA (Scott & Bruce, 1994); limited support for trust (Holzner & Fisher, 1979); and implicit support for autonomy (Blegen, Goode, Johnson, Maas, Chen, & Moorhead, 1993; Boughn, 1995; Dwyer, Schwartz, & Fox, 1992; Schutzenhofer, 1994). The ability of each of these to influence research utilization also makes intuitive sense. However, this was not the case in this study.

The dogmatic (closed minded) individual should use research less. The individual with a higher index of trust in the scientist should use research more. The higher the nurse rates herself on PSA, the higher should be her use of research which is an activity bearing many similarities to problem solving. The more autonomous a nurse, the greater

should be her use of research. In this study autonomy was not only not significant, but its effect was in the opposite direction to that which I expected! While it may be easier to accept that my operationalizing of trust was inadequate, and not tested in any prior conditions; it is less easy to dismiss the autonomy, PSA, and dogmatism scales, each of which has demonstrated that they have acceptable psychometric properties. A plausible explanation for the failure of this and other concepts which were measured using scales is described in the section on implications that follows.

The final concept that failed to demonstrate a significant effect is cosmopoliteness. This concept has quite a strong base of support in the literature (Crane, 1989; Gingess et al., 1994; Kaluzny et al., 1970; Kimberley, 1981; Kimberley & Evanisko, 1981; Mohr, 1969; Rogers, 1995)[10] and consequently I was surprised when it did not remain in the models through the validation and combined run processes. My operationalization was similar to that of Crane (1989) and Gingess et al. (1994), both of whom reported that it was a significant predictor of research utilization and innovativeness, respectively. While I am quite confident in how I operationalized cosmopoliteness, this should be explored further because of limited experience with it in nursing, and in light of fairly strong support for it in the literature. On the basis of findings in this study I would tentatively conclude that perhaps the attention given to this concept as a predictor of research utilization in nursing may not be warranted, at least not with staff nurses.

The Retained Concepts

Inservices attended. Although I located no reports of the inclusion of this concept in research utilization studies as a predictor variable, it is a plausible predictor of research utilization, and may be somewhat related to conferences attended. In this study, conferences attended was conceptualized as part of the 'cosmopoliteness' concept discussed in the previous section, and as such, I considered it to be different from inservices attended in that, inservices are usually attended in one's place of work and relate directly and immediately to the work at hand. Additionally they are attended on employer time. Conferences on the other hand are not usually employer supported for staff nurses in Alberta[11] and their attendance by staff nurses was construed by me to reflect a greater commitment to continuing education and professional development. The failure to pay more attention to this variable is interesting. Inservices have a long standing history in hospital and other health care institutions and are a primary vehicle for transmitting information to staff. They are often given by trusted members of the health team from nursing and other professions, are usually specific to immediate problems

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[10]Of these, however, only Crane's (1989) work represents a nursing context.

[11]A question on the survey validated this, at least for staff nurses and suggested that staff nurses had never had significant financial support to attend conferences, especially those out of province.

facing nurses, and because they are frequently on employer time, they have a reasonably good attendance record. Their potential for disseminating research is not trivial, nor is their potential to play an active role in utilization.

Attitude. The retention of attitude as an influential concept was not surprising. It has been demonstrated on several occasions that a positive attitude to research influences research utilization positively (Bostrum & Suter, 1993; Champion & Leach, 1989; Lacey, 1994; Rizutto et al., 1994). Attitude to research more generally has also been studied (Ehrenfeld & Eckerling, 1991; Harrison, Lowrey, & Bailey, 1991; Marsh & Brown, 1992) with the suggestion that it can be altered by various educational interventions. Its many implications for educators, in particular, have been well documented. This study reinforces its importance. What may be of additional and future interest from this study are possible relationships that have not yet been explored between attitude and other concepts such as dogmatism, trust, and belief.

Belief. Earlier in this report I indicated that I would turn my attention to this concept more fully in this chapter. The reason for doing so is that this concept was retained in the modeling exercises as exerting a significant effect and it is a concept that has not, to my knowledge, been specifically identified before in the literature on research utilization. I define it as: *the willingness and the ability to use sound research even when it contradicts what the individual has learned prior to nursing school, during nursing school, or in the workplace.* The term belief, which I now think should be changed to something more descriptive,[12] came from my original thinking which went something like:

> Sometimes as nurses we hold beliefs so strongly that it is difficult to overcome them and use research that we know to be valid because it runs counter to those beliefs. For example, if one is taught from an early age at home that wounds heal best when left to open air, and especially if this is reinforced in nursing school and/or the workplace with practices (now outdated) such as funnelling dry oxygen onto open pressure sores to facilitate healing, then it may be very difficult to overcome those beliefs and accept that closed wound healing (current research evidence) is more effective. The ability *to overcome information that has become ensconced as a strongly held belief* or put another way, this ability to *suspend strongly held beliefs*, is characteristic of the nurse with this quality, within the context of research utilization.

There are hints of this "belief suspension" or "research receptivity" scattered throughout the literature. For example, Stetler (1994b) indicates that the nurse has to believe the

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[12]I am not yet entirely convinced that I have located a satisfactory replacement, however, I think that terms such as "research receptivity" or "belief suspension" are closer in meaning to the concept.

research findings. Backer (1991) says the adopter must be convinced that the innovation will work. Lindquist (1988), discussing information more broadly than research, suggests that when using cognitive decision appraisal that the screening and use of information is determined by the belief structure of decision makers. This is comparable to much policy analysis literature which describes the role of core values and beliefs in influencing policy development, and with Lomas (1990) who also discusses core values and beliefs within the context of research use in the public sector. Whether this "research receptivity" is part of some innate personality characteristic of an individual or whether it can be actively fostered (I think the latter) remains to be assessed. Additionally, this concept should be closely examined for similarities and differences from other concepts such as dogmatism, open-mindedness, trust, attitude, and risk taking. One could conceive that it would be necessary to have large amounts of the "research receptivity" to overcome strong cultural practices on a nursing unit that insisted for example, that women with hyperemesis gravidarum should be made to clean up there own emesis as a part of recovery;[13] or to overcome strong educational influences such as those which encouraged us to associate gastric ulceration almost exclusively with personality type.[14]

Implications of Modeling the Individual and Professional Factors

The implications from this set of findings can be grouped as implications for: modeling, measurement, and strategies to enhance research utilization. While the modeling exercises undertaken in this study specific to the individual and professional factors influencing research utilization may have nearly exhausted the possibilities of locating a better fitting model[15] I do not yet consider the modeling complete as is described in a later section.

Modeling implications. There are two main modeling implications. First, when examining the concepts that "fell out" of the models in chapters six through eight, and asking if any of them could in any way be salvaged, it is clear that they cannot be if they

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[13]While an unfortunate and perhaps extreme example of a strong and erroneous unit norm, this is nevertheless an actual example of the kind of workplace beliefs at work in some institutions. [note: hyperemesis gravidarum is a condition of persistent vomiting during pregnancy, that extends far beyond the "morning sickness" of the first trimester].

[14]We now know that in many cases a bacterium is responsible for ulcers, and while personality has not been discounted as an influence, the immediate treatment in such case is antibiotics, not a "sippy" diet and the teaching of stress reducing biofeedback techniques.

[15]This is a simply a reflection of the mathematical implications of adding additional constraints to the model in figure 11, including reciprocal and indirect effects. Any additional constraints can only make it less likely that I will successfully locate a more complete individual model because these constraints will require that the data be "stretched" even further than they already are--model fit indices are already beginning to show warning signs of a breakup in the integrity of the model with this set of concepts.

are placed in the model as exerting a direct effect on research utilization. However, it may be that some of them exert an indirect effect through one or more of direct, indirect, or persuasive research utilization, or through attitude, inservices, or research receptivity. While this is not likely to result in a better fitting model its possibilities should be pursued, especially when later considering the innovation attributes and the organizational concepts, and their theoretically reasonable location in any causal model of research utilization. The second implication in this area is more straight-forward--it is more economical to take a few individual concepts into further modeling exercises than it was to take the extensive set attempted in this study.

Measurement implications. The measurement implications centre around the fact that several concepts in this study were measured with scales, namely attitude, autonomy, PSA, dogmatism, research receptivity (belief), and trust. Others were composites, the scores being arrived at by adding a number of related activities, e.g., cosmopoliteness and activism. The possibility exists that in some of these scales that the items are not all measuring precisely the same concept despite relatively high internal consistencies reflected in alpha coefficients.[16]

This raises the issue of the dimensionality of concepts. It has been common in nursing to consider concepts to be multi-dimensional and to consider the number of factors determined by a factor analysis procedure to represent the number of dimensions of that concept. This has led logically to the belief that concepts are best measured by multiple item scales in order to completely "tap" the concepts, especially if it is a concept that we consider to be "complex." In this process however, it is possible that individual items may correlate differently with the dependent variable and influence the summative scale score such that the concept has no significant effect on the dependent variable. If for example, some items correlate very highly and others negatively, it is possible to "cancel out" the effects of both groups. This cancelling out would suggest that the items may represent different concepts, that is, the multiple dimensions (factors) of a concept may actually represent separate concepts because they participate in different causal structures. It may be more fruitful to think of concepts as uni-dimensional, varying only on the dimension of magnitude. In such a conceptualization we would be less likely to confound our modeling exercises with scales that may not represent the single concept we believe we are entering into the structural equations. In this case, for multiple items of a concept to function acceptably, they would have to be redundant with each other. The four multiple indicators of research utilization in figure 5 are an example of nearly perfect redundancy.

With this in mind, an important measurement implication of these findings is that concepts that did not reach significance (autonomy, dogmatism, PSA, trust) should be re-examined. Specifically, zero order correlations on the individual items making up the

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[16]Dogmatism (.72), PSA (.74), attitude (.77), autonomy (.85), belief (.87), trust (.91)

scales should be run with the dependent variable and those correlations examined for any of the patterns described above. Subsequently, highly correlated items should be entered as a set of two or three multiple indicators of the concept, and if successful, additional items added until model failure is reached. This is in all likelihood the only probable way that any of these concepts may be salvaged. The results of such an exercise will also provide useful information to further the discussion on the dimensionality of concepts.

Strategies to enhance research utilization. The last set of implications arises from the practical significance of findings such as these. A series of causal models, while theoretically interesting are of little practical value if they do not offer some guidance in achieving the end goal of increased research utilization among nurses. While the directions from this study are limited in this regard, some practical implications can be identified that carry little if any risk. Additionally, the idea that individual influences on research utilization are relevant needs to be briefly addressed.

The most obvious strategy that might be considered on the basis of this study is increased attention to the potential value of a systematic inservice education programme in encouraging increased use of research. Additionally, with an awareness that a positive attitude to research and a willingness to use research are important influences, that same inservice education programme could incorporate an "enculturation" dimension as well. Such a "cultural-suasion" could be incorporated into hiring, orientation, inservice, and other continuing education elements of the workplace. This is not a new concept, several years ago, magnet hospitals in the United States with their unique cultures and positive impact on staff satisfaction and retention, were well described in nursing (Kramer, 1990; Kramer & Schmalenberg, 1988a, 1988b). This idea is likely even more relevant in the mid-nineties in light of the tremendous upheaval as a result of health care restructuring in Canada.

Pursuing individual influences on research utilization is an approach that some may criticize as offering a poor return on investment; arguing that only larger scale organizational change and strategies offer reasonable returns. While it is probably true that organization and profession level interventions will produce the most dramatic results, it is with *individuals within those institutions* that any successful strategies will be implemented. It could also be argued that if institutions successfully mobilized their "quality" programmes that research use could be forced in this way. After nearly 20 years of experience with quality programmes I believe that first, unless nurses are persuaded on an individual level to use research, that those programmes cannot reach their potential; and second, that most of the work of nurses is conducted outside the boundaries of quality programmes and is therefore not susceptible to their effects in ways that we have traditionally thought. Additionally, nurses are increasingly practising in settings outside of conventional hospitals and may be less influenced by traditional institutional approaches than in the past.

Future Research

The first set of steps following from this study include: completion of the modeling of individual concepts as described in the previous sections, including the work on examination of the scales; and development and assessment of a model or models that incorporate organizational variables and attributes of the innovation. A second set of steps includes subsequent analyses of individual questions within the survey that were not addressed in this study. These include the questions on knowledge sources, reading patterns, and access to resources. Heeding Weiss' words of over 15 years ago, "until we can resolve questions about the definition of use, we face a future of noncomparable studies of use and scant hope of cumulative understanding..." (1981, p. 25), a third step is further exploration of the *extent* of research utilization which needs both theoretical and empirical examination, both of which can be done using this study as a stepping off point, and additional analysis of the data set.

Also useful from this data set will be closer examination of possible differences between groups of nurses in this study (e.g., public health, critical care, geriatric, etc.) on variables related to research use. An important element that is currently missing from the nursing literature is a critical review that examines our current status in nursing in this field. Such a review could assist us in refocusing some of our efforts pointing to directions gleaned from both within and outside of the discipline. It would also possibly assist with the relatively limited amount of "cross pollination" presently occurring among fields such as nursing, medicine, social work, psychology, organizational analysis, and policy analysis.

Conclusion

Looking at the broad field of research utilization in nursing at the end of this study, I am led to make a number of generalizations before drawing together final thoughts on the place of this study in the larger scheme of things. Current conceptualizations of research utilization in nursing are primarily restricted to large process models that depict how we get research findings from scientific journal article to bedside practitioner. In addition to those large process models, we have a growing, but still scattered body of empirical studies whose findings are equivocal, and which do not, for the most part, employ consistent theoretical and conceptual definitions or methods across studies. From those studies and from a large body of descriptive literature we have developed identifiable cultural beliefs about this area we call research utilization. Among them are the notions that practising nurses do not use research and that research based practice is sanctified. Neither of these has a strong base of evidence to support it, and while each may seem intuitively correct, and may indeed be partially correct, neither should be promoted in the absence of more compelling evidence than we have accumulated thus far. Finally, we have yet to see evidence in our literature of syntactical or substantive debate in this area within nursing, probably an indication that we do not

yet have a critical mass of researchers working cohesively on the problems in the area. Until such time as we do have such debates we cannot be confident that we are progressing satisfactorily toward better science in the field.

What, if anything has this study, and have I, accomplished or contributed to better science in the field? I believe there is a contribution in two areas. First, I have described an approach to theory development and testing that is workable and can result in useable mid-range theory. We continue to be in need of substance in nursing and substance must take a form, such as formal theory that is connected to the practice world in some manner. Second, I have begun to isolate some of the relevant factors in developing a causal theory of research utilization. Most importantly, I have identified and examined a formal structure of research utilization that includes three concepts, which while not new have not previously been modeled or thought of causally in nursing. I have also examined a large number of individual concepts for their possible role in a developing theory of research utilization and called into question some of our common conceptualizations of how individual factors work to influence research use.

There are a number of gaps and methodologically problematic areas in research utilization investigations; in particular and of interest to me, there has been a void in the development of causal theory. This study which used structural equation modeling contributes to existing research utilization investigations by beginning to fill this void, and further, by contributing to the development of a theory of research utilization within nursing.

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Appendix A

Research Utilization Survey

(26 pages)

Research Utilization in Nursing

An Alberta Survey of Practising Nurses

1996

Investigator:
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GENERAL INSTRUCTIONS

Complete all sections of the questionnaire. Do not leave any questions unanswered. Following the general guidelines below will help ensure nurses interpret questions in a similar manner. It will also help with a fair analysis of your answers:

Unless stated otherwise, for every question your answers should apply to:

- the time period of the past one year
- the clinical area/job in which you have spent the most time in the past one year
- what you actually do, not what you think you should do
- your best estimate when you cannot recall exactly

A question about **overall research utilization** is asked several times throughout the questionnaire. Do not go back and change any of your answers. Please remember **there are no right or wrong answers** to any of the questions. Use the following **DEFINITION OF RESEARCH** throughout the questionnaire:

knowledge, ideas, and/or techniques learned as a result of research studies conducted by trained researchers

Participation in this study is voluntary. Your consent is given when you return the questionnaire in the enclosed, stamped envelope. The return envelope has an identifying number on it to facilitate mailing of reminder letters. The questionnaire itself, which is separated from the envelope on receipt, contains no identifying information. Responses are anonymous and only grouped responses will be reported. The plain numerical data (with no identifying information from any of the participants) will eventually be stored in the University of Alberta's data library where it will be available to other researchers. I will also keep a copy of this plain numerical data so that I can do additional analysis. This study has been approved by a research ethics review committee.

WRITE ANY ADDITIONAL COMMENTS YOU HAVE ON
THE LAST PAGE OF THE QUESTIONNAIRE BOOKLET

Thank-you in advance for taking the time to complete this questionnaire!

SECTION I: RESEARCH UTILIZATION

OVERALL RESEARCH UTILIZATION

For the next **six** questions please use the following definition of **overall *research utilization*:**

> The use of any kind of research findings (nursing and non-nursing), in any kind of way, in any aspect of your work as a registered nurse. Do **not** count as research, things you learned in the nursing school where you did your *basic* nursing training.

Consider the following questions carefully. Do not look ahead in the questionnaire and do not change your answer once it has been selected.

1. Overall, in the past year, how often have you used research in some aspect of your nursing practice?

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

2. At one time or another, people writing in nursing have considered the items on the following list to be research utilization. When your actions are based on the findings of sound research, do YOU consider the following to be research utilization? (Circle answer)

Changing an aspect of your own personal nursing practice	YES NO
Changing a practice or routine on your "unit" or in your work area	YES NO
Trying a new procedure, technique, or other nursing intervention	YES NO
Changing a nursing procedure, technique, or other nursing intervention	YES NO
Changing a nursing policy, technique, or other nursing intervention	YES NO
Changing your beliefs about a particular approach or procedure	YES NO
Educating or informing the patient or client	YES NO
Educating or informing another nurse	YES NO
Educating or informing another health professional	YES NO
Educating or informing a member of the public	YES NO
Persuading another nurse to make a change	YES NO
Persuading another health professional to make a change	YES NO
Persuading a patient or client to make a change	YES NO
Persuading a member of the public to make a change	YES NO
Other (Specify:_____)	YES NO

3. If the items in question 2 above are considered to be research utilization, overall in the past year, how often have you used research in some aspect of your nursing practice?

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

4. Would you use research more often in your practice if you could?

YES.....	3
MAYBE.....	2
NO.....	1
DO NOT KNOW.....	8

5. Do you agree with the statement: "if nurses used research more in their practice it would make a positive difference to patient care and outcomes"?

strongly disagree				strongly agree
1	2	3	4	5

6. What is the <u>one</u> most common source from which you learn about research findings? Be as specific as possible.

_____

DIRECT RESEARCH UTILIZATION

For the next three (3) questions please use the following definition of **direct research utilization**:

> The use of research findings (nursing and non-nursing) where you **directly use the findings** in giving patient care and/or in client interventions. Do not count as research, things you learned in your *basic* nursing training.

Direct research use often results in protocol, procedure, routine or policy development. The following are examples of research that can be used in this direct way:

- Internally rotating the femur during injection into the dorsogluteal site, in either the prone or side-lying position to reduce discomfort.
- Limiting suctioning (and other interventions known to increase intracranial pressure [ICP]) in ventilated patients with known or suspected high ICP.
- Working with pregnant women to help them quit smoking (because of the adverse effect of smoking during pregnancy on birthweight)
- Following current CDC immunization guidelines in child health clinics.

7. Overall, in the past year, how often have you *used research findings in this **direct** way* in some aspect of your nursing practice?

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

8. How often have you avoided using research in this *direct way* because you did not believe you had the *authority* to do so, even though you were convinced of the usefulness of the research?

never	rarely	sometimes	frequently	always
1	2	3	4	5

9. Still considering this ***direct*** kind of utilization, how many times in the past year have you encountered a research finding or recommendation:

SCALE:

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

(a)	that you <u>completely</u> implemented?	1	2	3	4	5	6	7	8
(b)	that you <u>partially</u> implemented?	1	2	3	4	5	6	7	8
(c)	that you <u>modified</u> to fit your situation and then implemented?	1	2	3	4	5	6	7	8
(d)	where you <u>did nothing</u>, that is, did not implement the finding or recommendation?	1	2	3	4	5	6	7	8

INDIRECT RESEARCH UTILIZATION

For the next question please use the following definition of **indirect research utilization** *which is different from the definition for direct utilization given above.*

> The use of research findings (nursing and non-nursing) to **change your thinking or your opinions** about how to approach certain patient care or client situations. Do not count as research, things you learned in your *basic* nursing training.

Indirect research use usually does *not* result in protocol, procedure, routine or policy development. The following are examples of research that can be used in this indirect way:

Because you are aware of the stages of death and dying, you understand a newly diagnosed cancer patient's refusal to believe the diagnosis.

Whenever possible, you schedule night routines with an awareness of the normal sleep cycle (e.g., 90 minutes), so as not to interfere with patients' sleep and rest.

Knowing that smoking during pregnancy can result in low birth weight babies, you anticipate lower birth weight and other related problems in babies of smoking mothers.

Based on the knowledge that pregnancy is sometimes a trigger for domestic violence you raise your index of suspicion during prenatal visits.

10. Overall, in the past year, how often have you used *research in this **non-direct** way* in some aspect of your nursing practice?

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

PERSUASIVE RESEARCH UTILIZATION

For the next two (2) questions please use the following definition *which is different from the definitions for direct and indirect research utilization:*

> The use of research findings (nursing and non-nursing) to **persuade others, who are usually in decision making positions, to make changes** in conditions, policies, or practices relevant to nurses, patients/clients, and/or the health of individuals or groups. Do not count as research, things you learned in your *basic* nursing training.

The following are examples of research that can be used in this persuasive way:

Because you know that people in lower income groups have a higher incidence of chronic and communicable disease, and domestic violence, you and/or your unit prepare a special report to your regional health authority when social assistance is cut to single mothers in your area.

You use your knowledge of the adverse effects of irregular shift rotations on employee performance and health to persuade your supervisors to improve the shift rotation in your unit.

You use your knowledge of recent research which demonstrates that male infants experience significant pain during circumcision to persuade a physician you work with to use a local anaesthetic during the procedure.

11. How often have you used knowledge of particular research findings to try to **persuade** the following groups of people to make changes in this way, in the past year:

	never	rarely	sometimes	often	do not know
(a) nurse co-workers	1	2	3	4	8
(b) physicians	1	2	3	4	8
(c) other health professionals	1	2	3	4	8
(d) nurse administrators	1	2	3	4	8
(e) non-nurse administrators	1	2	3	4	8
(f) community leaders	1	2	3	4	8
(g) government representatives	1	2	3	4	8
(h) members of the public	1	2	3	4	8
(i) other (specify:_____)	1	2	3	4	8

12. Overall, and including all of the categories of people in #11, in the past year how often *have you used research in this **persuasive** way*?

never	on 1 or 2 occasions			on about half of possible occasions		on nearly all possible occasions	do not know
1	2	3	4	5	6	7	8

OVERALL RESEARCH UTILIZATION

In the next question please **reassess** your research utilization using the original definition of overall *research utilization*:

> The use of any kind of research findings (nursing and non-nursing), in any kind of way, in any aspect of your work as a registered nurse. Do not count as research, things you learned in your basic nursing training.

13. Overall, in the past year, how often have you used research in some aspect of your nursing practice?

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

14. If you circled a number from 2 to 7 in the above question, estimate how much of the research that you used was:

____% nursing
____% medical
____% other
100%

SECTION II: BACKGROUND AND DAILY DEMANDS

1. Are you...

FEMALE	1
MALE	0

2. In what year were you born? **19____**

3. What is your current marital/partner status?

Married (and living with spouse)	1
Living with partner/living common-law	2
Single	3
Separated, widowed, divorced	4
Other (Please specify:_____)	5

The following questions are about your educational backgroumd.

4. Your basic nursing education was?

Hospital Diploma	1
College Diploma	2
University Degree (BScN, BN, etc)	3

5. In what year did you complete your basic nursing education? **19____**

6. What is your highest completed level of formal nursing education?

Diploma	1
Bachelor's Degree	2
Master's Degree	3
Other (Specify:_____)	4

7. When did you complete your highest level of nursing education? **19____**

8. Do you hold a CNA speciality certification?

YES	1
NO	0

9. If yes, which certification did you complete and when did you complete it?

(a) _____ (SPECIALITY) (b) 19____ (YEAR)

10. Have you completed any other nursing speciality or certificate programs?

YES..... 1
NO..... 0 **[IF NO, GO TO #12]**

11. If yes,which speciality or program and when did youcomplete it?

(a) _____ (b) **19**____
(PROGRAM) (YEAR)

12. What is your highest completed level of non-nursing post-secondary education?

Diploma..... 1
Bachelor's Degree..... 2
Master's Degree..... 3
Other (Specify:_____)..... 4
Not Applicable..... 5

13. If question 12 was applicable to you, in what year did you complete this program?
19____

14. Are you currently enrolled in an educational program or course?

YES..... 1
NO..... 0 **[IF NO, GO TO #16]**

15. Which of the following best describes the program you are currently enrolled in?

Certificate/diploma (Non-nursing)..... 1
Certificate/diploma (Nursing)..... 2
Bachelor's Degree (Non-nursing)..... 3
Bachelor's Degree (Nursing)..... 4
Master's Degree (Non-nursing)..... 5
Master's Degree (Nursing)..... 6
Other (Specify:_____)..... 7

The following questions are about the kind and amount of work that you do as a nurse.

16. On average....

a. how many **hours per week** do you presently work? _____hr/wk
b. how many **hours per week** did you work last year? _____hr/wk
c. how many **hours per week** did you work in the last five years? _____hr/wk

17. What is your primary clinical area (where you work the most hours)? Check one only.

__general medical
__general surgical
__pediatrics
__maternal/newborn
__psychiatric/mental health
__oncology
__operating/recovery room
__emergency care
__adult critical/intensive care
__pediatric critical/intensive care
__neonatal critical/intensive care
__several clinical areas (e.g., float or casual)
__ambulatory care
__geriatric/gerontology (acute care)
__geriatric/gerontology (long term care)
__rehabilitation (acute care)
__school health
__home care/home health
__community/public health
__occupational health
__independent practice (specify:_____)
__other (specify:_____)

18. What shift do you usually work? (consider the past 12 months). Circle one.

8 hour days..... 9
12 hour days..... 8
8 hour evenings..... 7
8 hour nights..... 6
12 hour nights..... 5
Rotate between:
8 hr. (circle combination: D/N, D/E, E/N)..... 4
8 hr. D/E/N..... 3
12 hr. D/N..... 2
Other (specify:_____)..... 1

19. How satisfied are you with the shift schedule that you currently work?

very dissatisfied				very satisfied
1	2	3	4	5

20. Which of the following best describes your employment status today?

Full time..... 3
Part time..... 2
Casual..... 1
Not employed..... 0

21. If your job title is different from *general duty registered nurse*, please state below:

_____

22. Excluding your basic nursing training, how many years have you worked as a nurse? Do not count periods where you did not work for 6 months or more.

NUMBER OF YEARS:_____

23. Overall, how satisfied are you with your present job?

very dissatisfied				very satisfied
1	2	3	4	5

Questions 25 through 30 ask about a variety of activities related to lifestyle, health, family, community and other commitments on your time that you may have.

24. How many children do you have?

NUMBER OF CHILDREN: ____
or
NONE..... 0

25. How many dependant adults, such as an aging parent or a disabled adult, do you have responsibility (involving your time) for?

NUMBER DEPENDENT ADULTS: ____
or
NONE..... 0

26. Do you vote in the following?

	never				always
a. Federal Elections.....	0	1	2	3	4
b. Provincial Elections.....	0	1	2	3	4
c. Municipal Elections.....	0	1	2	3	4
d. AARN/UNA/SNA Elections.....	0	1	2	3	4

27. In the past year, how often have you....

	never	once	twice	three times	four or more times
a. Organized a petition.....	0	1	2	3	4
b. Signed a petition.....	0	1	2	3	4
c. Marched in protest of something...	0	1	2	3	4
d. Written a letter to a politician.....	0	1	2	3	4
e. Written a letter to an editor.....	0	1	2	3	4

28. On <u>average</u>, how many **hours per week** do you spend:
(put "0" for no hours and n/a if not applicable)

a._____ With your children
b._____ With dependent adults
c._____ In recreational or competitive exercise
d._____ On political activity
e._____ In community service work (e.g., community league, school activities, distress lines, food banks, church activities, associations such as diabetes and cancer, shelters, boys and girls clubs, etc.)

29. Which of the following categories best describes your **total household** income for this past year before taxes and other deductions?

Less than $10,000	1
$10000 to $19,999	2
$20,000 to 29,999	3
$30,000 to 39,999	4
$40,000 to 49,999	5
$50,000 to 59,999	6
$60,000 to 69,999	7
$70,000 to 79,999	8
$80,000 to 89,999	9
$90,000 to 99,999	10
$100,000 or more	11

SECTION III: INDIVIDUAL AND PROFESSIONAL FACTORS

In the next section you will be asked questions about yourself as a professional. There are no right or wrong answers to these questions. It is important that you answer every question.

1. For each item, please circle the one number that best describes your beliefs about research.

	disagree strongly	disagree	uncertain	agree	agree strongly
a. Research is needed to improve nursing practice continually	1	2	3	4	5
b. Research findings are too complex to use in practice	1	2	3	4	5
c. I would change my practice as a result of research findings	1	2	3	4	5
d. Research is not applicable to my practice	1	2	3	4	5
e. Research helps to build a scientific base for nursing	1	2	3	4	5
f. It takes too much effort to apply research to practice	1	2	3	4	5

The following questions relate to the kind of knowledge you use in your nursing practice.

2. THE KNOWLEDGE THAT I USE IN MY PRACTICE IS BASED ON. . . .

	never	seldom	sometimes	frequently	always
a. information that I learn about each patient/client as an individual.....	1	2	3	4	5
b. my intuitions about what seems to be "right" for the patient/client.....	1	2	3	4	5
c. my personal experience of nursing patients/clients over time.....	1	2	3	4	5
d. information I learned in nursing school.....	1	2	3	4	5
e. what physicians discuss with me.....	1	2	3	4	5
f. new therapies and medications that I learn about after physicians order them for patients	1	2	3	4	5
g. articles published in **medical** journals	1	2	3	4	5
h. articles published in **nursing** journals.....	1	2	3	4	5
i. articles published in **nursing research** journals.....	1	2	3	4	5
j. information in textbooks.....	1	2	3	4	5
k. what has worked for me for years.....	1	2	3	4	5
l. the ways that I have always done it.....	1	2	3	4	5
m. the information my fellow nurses share.....	1	2	3	4	5
n. information I get from attending inservices/conferences.....	1	2	3	4	5
o. information I get from policy and procedure manuals.....	1.	2	3	4	5
p. information I get from the media (e.g., popular magazines, television, the Internet, etc).....	1	2	3	4	5

3. In the past **five (5) years**, how many of the following kinds of nursing conferences or conventions have you attended? Write in the actual number or "0" if none.

NUMBER:

a.____Clinical
b.____AARN or CNA
c.____Union
d.____Other (Specify:_____)

4. In the **last five years** have you attended conferences or conventions that have been: (Circle all that apply)

a. in Alberta.....	YES	NO
b. in the rest of Canada.....	YES	NO
c. in the United States.....	YES	NO
d. outside of North America.....	YES	NO

5. In total, how many nursing conferences or conventions have you attended in the **past 12 months**?

NUMBER:_____

6. How many nursing interest groups or organizations do you presently belong to? (e.g., Cdn. Intravenous Nurses Assoc., oncology nurses interest group, holistic nurses interest group, etc.). Put "0" if none.

NUMBER:_____

7. Are you a member of a union? (Circle all that apply)

UNA..... 1
SNA..... 2
Other..... 3 (Specify:_____)
None..... 4

8. How many of the following meetings have you attended in the past year?

AARN council or district..... NUMBER:_____
Union..... NUMBER:_____

9. How many continuing education and/or inservice sessions (½ to 4 hr. duration):

a. Do you attend in an average year..... NUMBER_____
b. Did you attend in the past 12 months..... NUMBER_____

10. How many statistics and/or research courses have you ever taken? Indicate "0" for NONE.

NUMBER: _____

11. How often have you read the following **nursing** journals in the past year?

	Times Per Year					
	never	once	2-4	5-7	8-10	>10
AARN Newsletter.....	0	1	2	3	4	5
Canadian Nurse.....	0	1	2	3	4	5
Nursing '96.....	0	1	2	3	4	5
American Journal of Nursing..	0	1	2	3	4	5
RN.....	0	1	2	3	4	5
Nursing Research.....	0	1	2	3	4	5
Cdn. Journal of Nsg Research..	0	1	2	3	4	5
Heart & Lung.....	0	1	2	3	4	5
Others:_____	0	1	2	3	4	5
_____	0	1	2	3	4	5
_____	0	1	2	3	4	5

12. How often have you read other **non-nursing but health related** journals in the past year?

Specify journals most read:

	Times Per Year					
	never	once	2-4	5-7	8-10	>10
a._____	0	1	2	3	4	5
b._____	0	1	2	3	4	5
c._____	0	1	2	3	4	5

13. How often have you read other **popular** journals or magazines in the past year?

Specify journals most read:

	Times Per Year					
	never	once	2-4	5-7	8-10	>10
a._____	0	1	2	3	4	5
b._____	0	1	2	3	4	5
c._____	0	1	2	3	4	5

14. Which of the following associations, organizations or groups do you **identify most closely with** as a nurse? Circle only one.

The organization in which you work.....	1
Your union.....	2
A Clinical Interest or Speciality Group.....	3
AARN and/or CNA.....	4
Other (Specify:_____).....	5

The next three (3) questions ask for some of your opinions about researchers and research findings.

15. How much faith do you have that nurse researchers will produce research. . .

	none				a great deal
a. that is **relevant** to you?.....	1	2	3	4	5
b. that is **easily used** by you?.....	1	2	3	4	5
c. that can **safely** be used in your practice?.....	1	2	3	4	5

16. How ***willing*** are you to implement research when it contradicts something you....

	very unwilling				very willing
a. learned *prior* to nursing school.....	1	2	3	4	5
b. learned *in* nursing school.....	1	2	3	4	5
c. learned in your place of work.....	1	2	3	4	5

17. How often do you ***actually implement*** research when it contradicts something you....

	never				very often
a. learned *prior* to nursing school.....	1	2	3	4	5
b. learned *in* nursing school.....	1	2	3	4	5
c. learned in your place of work.....	1	2	3	4	5

The following questions are about how you approach nursing your patients/clients and about who may have influenced your approach to nursing.

18. To what extent is your nursing practice guided by a theoretical position?

(Examples of theoretical positions include: hierarchy of needs, systems theory, self-care, body systems, adaptation, goal attainment, human becoming, general needs, person-environment interaction, etc.)

not at all					a great deal
0	1	2	3	4	5

19. Which of the following general approaches best describes how you practice nursing? Mark up to **three in order of importance** where "1" is the most important, "3" the least.

Hierarchy of Needs.....	☐	Goal Attainment.....	☐
Body Systems.....	☐	Interpersonal Interaction.....	☐
Systems Theory.....	☐	Person-Environ't Interact'n...	☐
Problem Based.....	☐	Human Becoming.....	☐
Self-Care.....	☐	Caring.....	☐
Adaptation.....	☐	Other (_____).....	☐

20. Which, if any, of the following individuals, whose writings about nursing have been incorporated into some nursing programs, has influenced how you practice nursing? Mark up to **three in order of importance** where **"1"** is the most important, **"3"** the least.

Virginia Henderson.....	☐	Sr. Calistra Roy.....	☐
Abraham Maslow.....	☐	Myra Levine.....	☐
Hildegard Peplau.....	☐	Ida Orlando.....	☐
Dorothea Orem.....	☐	Joyce Travelbee.....	☐
Jean Watson.....	☐	Rosemary Parse.....	☐
Betty Neuman.....	☐	Nursing Sch.Instructor.....	☐
Faye Abdellah.....	☐	No one has influenced me...	☐
Martha Rogers.....	☐	Other.....	☐
Imogene King.....	☐	(Specify:_____)	

THE FOLLOWING SERIES OF QUESTIONS (#21 TO #23) REPRESENT SCALES THAT MEASURE DIFFERENT ASPECTS OF PROFESSIONAL PRACTICE WHICH ARE THOUGHT TO RELATE IN SEVERAL WAYS TO RESEARCH UTILIZATION BY NURSES.

#21.

For each statement below, mark the response that BEST indicates how TRUE that statement is for you in YOUR PRACTICE.

Scale:

1	2	3	4	5
not at all true	slightly true	moderately true	very true	extremely true

IN MY PRACTICE I . . .

a. . .take responsibility and am accountable for my actions.....	1	2	3	4	5
b. . .have developed the image of myself as an independent professional	1	2	3	4	5
c. . .base my actions on the full scope of my knowledge and ability.....	1	2	3	4	5
d. . .take control over my environment and the situations I confront.....	1	2	3	4	5
e. . .have a sense of professionalism.....	1	2	3	4	5
f. . .make my own decisions related to what I do.....	1	2	3	4	5
g. . .have the power to influence the decisions and actions of others.....	1	2	3	4	5
h. . .demonstrate mastery of skills essential for freedom of action.....	1	2	3	4	5
i. . .establish the parameters and limits of my practice activities.....	1	2	3	4	5
j. . . accept the consequences for the choices I make.....	1	2	3	4	5

#22.

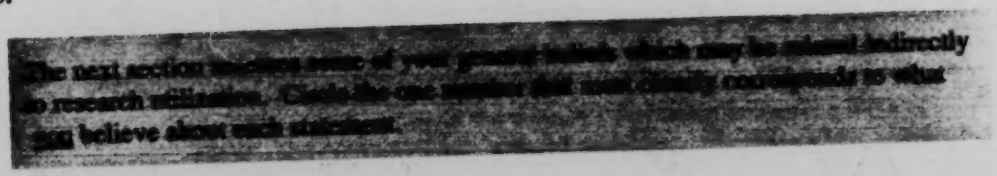
The next series of questions asks about your approach to solving problems. Please respond to the items as honestly as possible so as to most accurately portray how *you* handle personal problems. Your responses should reflect what you *actually* do to solve problems, not how you think you *should* solve them.

Scale:

1 strongly disagree	2 moderately disagree	3 slightly disagree	4 slightly agree	5 moderately agree	6 strongly agree

a.	When I have a problem, I think of as many possible ways to handle it as I can until I can't come up with any more ideas.....	1	2	3	4	5	6
b.	I have the ability to solve most problems even though initially no solution is immediately apparent.....	1	2	3	4	5	6
c.	When confronted with a problem, I tend to do the first thing that I can think of to solve it.....	1	2	3	4	5	6
d.	When considering solutions to a problem, I do not take the time to assess the potential success of each alternative.....	1	2	3	4	5	6
e.	When making a decision, I compare alternatives and weigh the consequences of one against the other.....	1	2	3	4	5	6
f.	Given enough time and effort, I believe I can solve most problems that confront me.....	1	2	3	4	5	6
g.	When faced with a novel situation, I have confidence that I can handle problems that may arise.....	1	2	3	4	5	6
h.	I trust my ability to solve new and difficult problems.....	1	2	3	4	5	6
i.	When confronted with a problem, I usually first survey the situation to determine the relevant information.....	1	2	3	4	5	6
j.	When confronted with a problem, I am unsure of whether I can handle the situation.....	1	2	3	4	5	6

#23.



Scale:

	1 STRONGLY DISAGREE	2	3	4	5	6	7 STRONGLY AGREE
a. In this complicated world of ours the only way we can know what's going on is to rely on leaders or experts who can be trusted.....	1	2	3	4	5	6	7
b. My blood boils whenever a person stubbornly refuses to admit they are wrong.....	1	2	3	4	5	6	7
c. There are two kinds of people in this world: those who are for the truth and those who are against the truth.....	1	2	3	4	5	6	7
d. Most people just don't know what's good for them.	1	2	3	4	5	6	7
e. Of all the different philosophies which exist in this world there is probably only one which is correct....	1	2	3	4	5	6	7
f. The highest form of government is a democracy and the highest form of democracy is a government run by those who are most intelligent.....	1	2	3	4	5	6	7
g. The main thing in life is for a person to want to do something important.....	1	2	3	4	5	6	7
h. I'd like it if I could find someone who would tell me how to solve my personal problems.....	1	2	3	4	5	6	7
i. Most of the ideas which get printed nowadays aren't worth the paper they are printed on.....	1	2	3	4	5	6	7
j. A person on their own is a helpless and miserable creature.....	1	2	3	4	5	6	7

SECTION IV: THE RESEARCH ITSELF

Research can have certain characteristics that influence whether or not nurses are able or inclined to use it in their practice. This section asks questions about your experience with and opinions about these characteristics.

In answering the questions in this section it may be helpful to choose one finding or group of research findings that you are aware of and keep it in mind as you answer each question. Examples that you might use include:

- **A closed sterile system is effective in maintaining the sterility of urine in patients who are catheterized for less than two weeks. Continuity of the closed urinary drainage system should be maintained at all times.**
- **Elimination of lactose from the formulas of tube-feeding diets for adult patients minimizes diarrhea, distention, flatulence, fullness, and reduces rejection of the feeding.**
- **Smoking during lactation reduces breast milk production.**
- **One indicator of appropriate maternal attachment is mother-infant eye contact.**

HOW IMPORTANT ARE THE FOLLOWING IN YOUR DECISION TO USE OR NOT USE PARTICULAR RESEARCH FINDINGS IN YOUR PRACTICE?

	not at all important				very important
1. The research matches my personal values.....	1	2	3	4	5
2. The research meets a clinical need.....	1	2	3	4	5
4. The research is easy to understand.....	1	2	3	4	5
5. The research is relatively easy to incorporate into my practice.....	1	2	3	4	5
6. The results of implementing the research are visible to me.....	1	2	3	4	5
7. The particular research based practice makes my job as a nurse easier.....	1	2	3	4	5
8. The particular research based practice makes me feel like a better nurse.....	1	2	3	4	5
9. The research is relevant to my particular practice situation.....	1	2	3	4	5
10. Others who have tried the research are positive about it.....	1	2	3	4	5

SECTION V: YOUR ORGANIZATION

This section asks about your place of employment, its resources, and the technology you may use. Answers to these questions will help identify the role of the workplace in research utilization and the possible role of technology in research utilization.

1. Where do you work? Circle **one** (choose the place in which you work the most hours).

Hospital (Less than 50 beds)..... **1**
Hospital (50-99 beds)..... **2**
Hospital (100-249 beds)..... **3**
Hospital (250-500 beds)..... **4**
Hospital (More than 500 beds)..... **5**

Non-hospital size scale:

Lg. Urban	=	Calgary or Edmonton
Medium Urban	=	Mid-size cities such as Grand Prairie, Lethbridge, Red Deer, Medicine Hat, Fort McMurray, etc.
Rural	=	Smaller centres (such as Canmore) and rural areas

Home Care Unit..... **6**
Size: (Circle one) LG. URBAN (3) MED. URBAN (2) RURAL (1)

Health Unit..... **7**
Size: (Circle one) LG. URBAN (3) MED. URBAN (2) RURAL (1)

Other organization..... **8**
Specify type: _____
Size: (Circle one) LG. URBAN (3) MED. URBAN (2) RURAL (1)

In the next two questions a ***very traditional*** organization or unit would be: resistant to change, make decisions cautiously based largely on past experience, and be hesitant to adopt new ideas. A ***very innovative*** organization or unit would be the opposite and could be described as "cutting edge."

Scale:

1	2	3	4	5	6
very traditional	quite traditional	somewhat traditional	somewhat innovative	quite innovative	very innovative

2. Circle the response that *in your opinion* best describes your **unit**.

1 2 3 4 5 6

3. Circle the response that *in your opinion* best describes your **organization**.

1 2 3 4 5 6

The next two (2) questions are about the presence or absence of a person who actively promotes and encourages ("champions") research in your place of work.

4. Is there someone in your organization who currently, or in the past year, has "championed" nursing research and/or research based practice (a research champion)?

___YES
___NO **[IF NO SKIP TO QUESTION #6]**

5. How important is this "research champion" to the frequency with which you use research in your practice?

not at all important				very important
1	2	3	4	5

6. If you have worked where there *was* a "research champion" in the **past five years**, how important was this "research champion" to the frequency with which you used research in your practice?

not at all important				very important	never worked with one
1	2	3	4	5	8

7. How often is there "down time" (i.e., time where you and/or your nursing colleagues can choose to do something "extra" for the patient or client) in your place of work ?

never	rarely	sometimes	quite often	frequently
1	2	3	4	5

8. Compared to <u>one</u> year ago, is this:

MORE..... 3
ABOUT THE SAME..... 2
LESS..... 1

9. Compared to <u>five</u> years ago, is this:

MORE.....	3
ABOUT THE SAME.....	2
LESS.....	1

These next questions are about the resources that are available to you both inside and outside your place of work.

10. How much **access** do you have to the following in your workplace?

	very little		some		a great deal	not available
a. Library (primarily medical).....	1	2	3	4	5	8
b. Library (with nursing material).....	1	2	3	4	5	8
c. Library computers	1	2	3	4	5	8
d. Internal electronic mail (e-mail).....	1	2	3	4	5	8
e. External electronic mail.....	1	2	3	4	5	8

11. How much do you **use** the following at work?

	never use	rarely	sometimes	freq'ly	nearly always	not available
a. Library (primarily medical).....	1	2	3	4	5	8
b. Library (with nursing material).....	1	2	3	4	5	8
c. Library computers.....	1	2	3	4	5	8
d. Internal electronic mail (e-mail).....	1	2	3	4	5	8
e. External electronic mail (e-mail).....	1	2	3	4	5	8

12. Do you....

	(circle)		
a. have a computer at home.....	YES	NO	**[IF NO, GO TO #14]**
b. use a computer at home.....	YES	NO	**[IF NO, GO TO #14]**

13. How much time <u>per week</u> on average do you spend at home on the following:

	none	<1 hr	1-4 hr	5-10 hr	>10	do not have
a. e-mail.....	1	2	3	4	5	6
b. the Internet (in addition to e-mail)..	1	2	3	4	5	6

14. Do you think that better access than you have now to any of the resources identified in the last 4 questions is important to whether or not you use research?

not at all important	somewhat important	quite important	very important	extremely important
1	2	3	4	5

These next questions are about the time available to you in your place of work for various activities related to research utilization.

15. On your "unit" is there ever time to:

	never	rarely	sometimes	quite often	frequently
Use the library.....	1	2	3	4	5
Read (journals/texts).....	1	2	3	4	5
Reflect on your practice.	1	2	3	4	5
Participate in projects....	1	2	3	4	5
Participate in research...	1	2	3	4	5

16. How often have you <u>done</u> the following <u>at work</u> in the past year?

	never	rarely	sometimes	quite often	frequently
Used the library.....	1	2	3	4	5
Read (journals/texts).....	1	2	3	4	5
Reflected on your practice.	1	2	3	4	5
Participated in projects.....	1	2	3	4	5
Participated in research.....	1	2	3	4	5

These next questions are about resources available to you in your place of work.

17. Is your immediate supervisor a:

a. Nurse___
b. Other___
(specify:_____)

18. Indicate the degree to which the following people are supportive of you using research in your practice:

	not at all supportive				very supportive	do not know
a. Other nurses in your area	1	2	3	4	5	8
b. Your immediate supervisor	1	2	3	4	5	8
c. Administration (nursing)	1	2	3	4	5	8
d. Administration (general)	1	2	3	4	5	8
e. Physicians	1	2	3	4	5	8
f. Other health professionals	1	2	3	4	5	8
g. Other (Specify:_____)	1	2	3	4	5	8

19. To what extent are the following organizational factors **present** in your workplace?

	not at all	rarely	sometimes	freq'ly	always	do not know
a. Nurses/others with research skills....	1	2	3	4	5	8
b. Paid time allotted for participation in various research activities.....	1	2	3	4	5	8
c. Attendance at research and clinical conferences encouraged.....	1	2	3	4	5	8
d. A group or commitee to review and critique research.....	1	2	3	4	5	8
e. Money from internal and/or external sources for research.....	1	2	3	4	5	8

20. To what extent do you think these organizational factors are, or would be, **important to your own use of research?**

	not at all important		quite important		extremely important	do not know
a. Nurses/others with research skills....	1	2	3	4	5	8
b. Paid time allotted for participation in various research activities.....	1	2	3	4	5	8
c. Attendance at research and clinical conferences encouraged.....	1	2	3	4	5	8
d. A group or commitee to review and critique research.....	1	2	3	4	5	8
e. Money from internal and/or external sources for research.....	1	2	3	4	5	8

21. Please rank the three resources that are, or you believe would be, important to assisting you in using research in your practice. **(1 = most important; 3 = least important)**

- ☐ Library access
- ☐ Paid time at work
- ☐ Nurses/others with research skills
- ☐ Presence of a research "champion"
- ☐ Computer connections to other sources of information, to e-mail, to the Internet, etc.
- ☐ Support of co-workers
- ☐ Support of immediate supervisor
- ☐ Support of administration
- ☐ Attendance at inservices and/or conferences

22. If you have ever used research in your practice, would you give an example of how you personally decided if it made a difference to the patient or client (i.e., how you **measured the outcome or result** of using the research)?

_____

_____

_____

_____

_____

23. If I have omitted anything about research utilization that is important to you, would you please add it below?

_____

_____

_____

_____

_____

OVERALL RESEARCH UTILIZATION

In the last question you are being asked to REASSESS your research utilization one final time. There is no *preference* about whether your answer to this question has stayed the same or changed throughout. Use the same definition you used earlier of overall *research utilization*:

> The use of any kind of research findings (nursing and non-nursing), in any kind of way, in any aspect of your work as a registered nurse. Do **not** count as research, things you learned in the nursing school where you did your *basic* nursing training.

24. Overall, in the past year, how often have you used research in some aspect of your nursing practice on all the occasions that you could have?

never	on 1 or 2 shifts			on about half the shifts		nearly every shift	do not know
1	2	3	4	5	6	7	8

THANK-YOU FOR YOUR TIME AND EFFORT

(Use the back of this page to write any additional comments)

Appendix B

Information letters and follow-up postcards

University of Alberta
Edmonton
Canada T6G 2G3

Faculty of Nursing
3rd Floor Clinical Sciences Building

February 1, 1996

Dear Nursing Colleague,

Many of you are working under difficult circumstances as *health reform* moves through the province. A central part of this reform is government's call for more "evidence based practice" and more accountability from nursing--which means that a clearer understanding of how and why nurses use research is important. I am surveying practising nurses in Alberta about their use of research.

You can help by completing and returning the enclosed questionnaire. It will take you 30-40 minutes. I am only mailing it to nurses who have indicated they are "staff nurses" because only practising nurses can provide the necessary information. The AARN gave me permission to have names randomly drawn from their mailing list. Nurses have frequently contributed to projects that have helped change the system for patients and clients. On this occasion your contribution will help change the system for nurses, as well as, for patients and clients.

The project is called *Research Utilization in Nursing: An Alberta Survey of Practising Nurses*. It is being done as part of my doctoral programme in nursing. My own clinical background includes many years in intensive care nursing where I first began to think about how to practise with the "best evidence." I would like to thank you in advance for your contribution to this project. It will be an important part of the overall success of the work and our ability to be convincing about the ways in which nurses contribute to the Alberta health care system.

If you wish further information, or wish to receive a summary of results when the study is done, you may contact myself or my supervisor at the following numbers:

Carole A. Estabrooks, RN, MN
PhD Candidate (Nursing)
(403) 436-2136

Phyllis Giovannetti, RN, ScD
Professor (Nursing) & Supervisor
(403) 492-2996

Thank you for your time and effort.

Sincerely,

Carole A. Estabrooks

REMINDER

Dear Nursing Colleague:

Recently, I mailed you a package of material concerning a study on research use by practising nurses in Alberta. I have not yet received your returned questionnaire. My purpose in writing now is to ask if you would give further thought to participating in this study.

If you have already mailed back the questionnaire--thank you, this card and your package have crossed in the mail.

Your participation in this study will help to make it a success. The results of this study will help explain to nurses, non-nurses and decision-makers the important role nurses in Alberta play in delivering evidence based care. If you have questions please call me at (403) 436-2136 or my supervisor, Dr. Giovannetti at (403) 492-2996.

Yours sincerely,

Carole A. Estabrooks, RN, MN
PhD Candidate (Nursing)
University of Alberta

Phyllis Giovannetti, RN, ScD
Professor (Nursing) & Supervisor
University of Alberta

University of Alberta
Edmonton
Canada T6G 2G3

Faculty of Nursing
3rd Floor Clinical Sciences Building

March 12, 1996

Dear Nursing Colleague,

In February I mailed you a questionnaire about research use among nurses and a reminder post card, but I have not yet heard from you. I recognize that you have a lot to contend with as *health reform* affects your part of the health system and I am mailing you another questionnaire and return envelope in case you have misplaced the first one. I hope that you are able to take the time to complete and return the enclosed questionnaire on research utilization. Your contribution will assist with the development of *evidence based practice* by nurses in Alberta. It is especially important now to develop a clearer understanding about research use by practising nurses because it will help non-nurses and decision makers better understand nurses' contribution to the Alberta health care system.

The questionnaire will take 30-40 minutes of your time. The AARN gave me permission to have names of staff nurses randomly drawn from their mailing list. Nurses have frequently contributed to projects that have helped change the system for patients and clients. On this occasion your contribution will help change the system for nurses, as well as, for patients and clients.

As I explained in my earlier letter, this study is part of my doctoral programme in nursing. If you wish further information, or wish to receive a summary of results when the study is done, you may contact myself or my supervisor at the following numbers:

Carole A. Estabrooks, RN, MN
PhD Candidate (Nursing)
(403) 436-2136

Phyllis Giovannetti, RN, ScD
Professor (Nursing) & Supervisor
(403) 492-2996

I hope you will participate in this study. *Your input is important in making the study representative of practising nurses in Alberta.* If you have already completed the questionnaire, thank-you, our responses have crossed in the mail. Thank you again for your time and effort.

Sincerely,

Carole A. Estabrooks

REMINDER

Dear Nursing Colleague:

Recently, I have mailed you a series of reminders about a study on research use by nurses in Alberta. I have not yet received your returned questionnaire. My purpose in writing now is to ask if you would reconsider participating in the study.

If you have already mailed back the questionnaire--thank you, this card and your package have crossed in the mail.

If you have any questions about the study please call me at (403) 436-2136 or my supervisor, Dr. Giovannetti at (403) 492-2996. Your participation as a *practising* nurse in this provincial survey of Alberta nurses is important. The results of this study will help explain the important role nurses play in delivering evidence based care. Thank you.

Yours sincerely,

Carole A. Estabrooks, RN, MN
PhD Candidate (Nursing)
University of Alberta

Phyllis Giovannetti, RN, ScD
Professor (Nursing) & Supervisor
University of Alberta

Appendix C

Variance/Covariance Matrix for Model 1

	RUO#1	RUO#2	RUO#3	RUO#4	RUDIR	RUIND	RUPERS
RUO#1	3.673						
RUO#2	2.696	3.389					
RUO#3	2.194	2.187	3.103				
RUO#4	2.191	2.148	2.463	3.143			
RUDIRECT	2.362	2.577	2.397	2.296	3.617		
RUINDIR	1.652	1.576	1.826	1.645	1.686	3.325	
RUPERSUA	1.103	1.216	1.252	1.205	1.192	1.108	3.107

Appendix D

Variance/Covariance Matrix for Model 2*

	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}
y_1	3.673									
y_2	2.696	3.389								
y_3	2.194	2.187	3.103							
y_4	2.191	2.148	2.463	3.143						
y_5	2.362	2.577	2.397	2.296	3.617					
y_6	1.652	1.576	1.826	1.645	1.686	3.325				
y_7	1.103	1.216	1.252	1.205	1.192	1.108	3.107			
y_8	0.493	0.366	0.465	0.299	0.373	0.278	0.367	1.379		
y_9	2.449	2.120	1.951	2.247	1.723	1.462	1.865	1.007	25.294	
y_{10}	0.056	0.009	0.016	0.012	-0.001	0.022	0.054	0.018	0.003	.060
y_{11}	-0.012	-0.013	-0.010	-0.010	-0.022	-0.022	-0.004	-0.011	0.001	-0.001
y_{12}	-0.043	-0.034	-0.038	-0.039	-0.076	0.018	-0.006	0.028	-0.066	-0.008
y_{13}	-0.098	-0.084	-0.047	-0.061	-0.083	0.017	-0.013	-0.004	0.186	-0.008
y_{14}	1.971	2.033	2.074	1.902	2.058	1.758	1.513	0.508	1.689	-0.034
y_{15}	0.617	0.572	0.545	0.771	0.524	0.635	1.568	0.378	5.580	0.149
y_{16}	2.572	2.029	2.400	2.270	1.701	2.150	1.936	0.861	3.631	0.216
y_{17}	2.026	2.464	2.148	2.051	2.416	1.331	2.941	0.312	2.725	0.059
y_{18}	3.322	2.789	2.492	3.228	1.841	1.653	2.588	0.943	9.404	0.033
y_{19}	-1.912	-2.117	-3.039	-2.439	-3.362	-2.534	-1.847	-0.782	-4.461	-0.079
y_{20}	1.185	1.387	1.240	0.910	1.078	1.052	1.003	0.609	-0.901	0.042

(....continued)

	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}	y_{16}	y_{17}	y_{18}	y_{19}	y_{20}
y_{11}	0.017									
y_{12}	-0.002	0.111								
y_{13}	-0.002	-0.015	0.106							
y_{14}	-0.019	0.004	-0.038	8.187						
y_{15}	-0.018	-0.031	0.224	0.831	21.858					
y_{16}	-0.065	-0.045	-0.071	3.217	8.813	29.083				
y_{17}	0.039	-0.036	0.058	4.731	3.056	5.173	22.475			
y_{18}	0.053	0.036-	0.363	4.732	6.209	5.461	6.834	40.569		
y_{19}	-0.067	-0.098	0.468	-5.610	-1.640	-7.030	-6.396	-1.885	68.126	
y_{20}	-0.003	0.073	-0.085	3.442	0.156	2.412	3.686	3.294	-1.870	7.237

*Corresponding variable names for Model 2 covariance matrix

y_1	RUO#1	y_{11}	AFFILO
y_2	RUO#2	y_{12}	AFFILP
y_3	RUO#3	y_{13}	AFFILU
y_4	RUO#4	y_{14}	ATTITUDE
y_5	RUDIRECT	y_{15}	AUTONOMY
y_6	RUINDIR	y_{16}	PSA
y_7	RUPERSUA	y_{17}	BELIEFT
y_8	THORIENT	y_{18}	COSMOPOL
y_9	ACTIVISM	y_{19}	DOGMATSM
y_{10}	AFFILC	y_{20}	TRUST

Appendix E

Variance/Covariance Matrix for Model 3**

	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}
y_1	3.673									
y_2	2.696	3.389								
y_3	2.194	2.187	3.103							
y_4	2.191	2.148	2.463	3.143						
y_5	2.362	2.577	2.397	2.296	3.617					
y_6	1.652	1.576	1.826	1.645	1.686	3.325				
y_7	1.103	1.216	1.252	1.205	1.192	1.108	3.107			
y_8	2.572	2.029	2.400	2.270	1.701	2.150	1.936	29.083		
y_9	3.322	2.789	2.492	3.228	1.841	1.653	2.588	5.461	40.569	
y_{10}	1.348	-.513	-1.415	.163	-1.100	-2.191	-.110	6.711	4.116	87.360
y_{11}	.013	-.006	.009	-.015	-.004	-.015	-.004	-.029	.061	-.033
y_{12}	.490	.463	.370	.636	.643	.224	.535	.655	-.273	3.282
y_{13}	1.359	-.631	-1.732	-.172	-.122	-1.814	-.080	3.330	.040	65.000
y_{14}	.512	.512	.352	.449	.448	.364	.127	-.098	-.386	.020
y_{15}	.035	.047	-.016	.015	.063	.027	.047	-.185	-.128	.314
y_{16}	.061	.050	.085	.013	.048	-.034	-.004	.293	.013	-.168
y_{17}	1.936	.078	-.474	-.024	-.070	-1.382	.323	4.620	2.592	59.099
y_{18}	1.059	.785	.693	.862	.105	.887	2.030	5.232	3.859	3.523
y_{19}	1.358	1.488	.847	1.088	.759	.366	.781	1.019	3.236	.005
y_{20}	.313	.230	.342	.332	.196	.260	.071	1.000	.568	-.631

	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}	y_{16}	y_{17}	y_{18}	y_{19}	y_{20}
y_{21}	1.077	1.168	1.320	-.407	1.311	2.449	.942	2.292	-2.650	1.934
y_{22}	.064	.081	.039	.036	.099	-.019	.067	.070	-.299	-.760
y_{24}	.116	.083	.111	.086	.129	.078	.038	-.019	.298	-.054
y_{25}	-.014	.001	.011	.027	-.010	-.019	.001	-.099	.190	-.061
y_{26}	.017	.012	.010	-.005	.004	.018	.026	-.028	.044	-.021
y_{27}	.183	.096	.088	.078	.120	-.071	.002	.095	.624	.606
y_{28}	-.027	.035	.041	.040	.036	.035	.029	.045	.015	-.013
y_{29}	-.055	-.061	-.041	-.045	-.040	-.008	-.006	.001	-.196	-.117
y_{30}	-.202	.160	.158	.159	.278	.217	.533	.010	-1.037	-2.348
y_{31}	.445	.288	.194	.156	.296	.066	.102	.335	-.595	1.512

(....continued)

	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}	y_{16}	y_{17}	y_{18}	y_{19}	y_{20}
y_{11}	.026									
y_{12}	-.045	6.513								
y_{13}	.093	5.104	98.243							
y_{14}	-.003	.200	.087	1.251						
y_{15}	.001	.448	.640	.027	.171					
y_{16}	.000	.043	-1.656	-.022	-.022	.428				
y_{17}	.022	3.549	58.767	.040	.328	.047	66.162			
y_{18}	-.049	-1.320	1.968	-.459	.081	-.483	2.513	40.336		
y_{19}	.005	.913	5.228	.453	.122	-.254	4.892	2.621	16.201	
y_{20}	-.008	-.063	-3.179	.003	-.076	.269	-.527	.866	-.205	1.079
y_{21}	-.268	1.240	-2.878	1.737	-1.209	.468	5.171	-1.702	10.141	.351
y_{22}	.006	.140	-.277	.006	-.006	-.014	-.265	-.075	.053	-.019
y_{23}	-.002	-.104	.603	.003	-.001	.018	.133	-.177	.016	-.076
y_{24}	-.001	.016	-.192	.054	-.001	.034	-.007	.023	-.056	.071
y_{25}	.002	-.013	-.057	-.003	.013	.012	.043	.179	.047	.036
y_{26}	.001	.028	-.164	.003	.005	-.003	.070	-.104	.063	.012
y_{27}	.001	.050	.089	.065	.005	.069	.678	.237	.123	.106

y_{28}	-.001	.041	.217	-.053	.020	-.005	.016	-.150	-.143	-.036
y_{29}	.002	.001	.022	.008	-.005	-.009	-.059	.063	-.144	-.012
y_{30}	.002	.458	-1.003	.232	.219	.038	-1.736	.462	-1.103	-.258
y_{31}	.002	.254	1.935	.604	.045	.079	1.760	-.012	.239	.033

(....continued)

	y_{21}	y_{22}	y_{23}	y_{24}	y_{25}	y_{26}	y_{27}	y_{28}	y_{29}	y_{30}
y_{21}	133.128									
y_{22}	.260	.165								
y_{23}	-.572	-.040	.156							
y_{24}	.069	-.015	-.014	.068						
y_{25}	-.021	-.012	-.012	-.004	.057					
y_{26}	.152	-.008	-.007	-.003	-.002	.035				
y_{27}	-.146	-.020	-.006	.049	.023	.013	.206			
y_{28}	-.633	.005	.006	-.007	-.005	.003	-.026	.082		
y_{29}	-.132	-.001	-.010	-.005	-.004	-.003	-.020	-.006	.066	
y_{30}	-4.414	.027	-.039	.002	.014	-.025	-.095	.061	.001	3.482
y_{31}	1.339	-.015	.003	.039	.023	.019	.205	-.025	.020	.266

	y_{31}
y_{31}	1.781

(...continued)

(...continued)

**Corresponding variable names for Model 3 covariance matrix

y_1	RUO#1	y_{24}	CLIN4
y_2	RUO#2	y_{25}	CLIN5
y_3	RUO#3	y_{26}	CLIN6
y_4	RUO#4	y_{27}	SHIFTDAY
y_5	RUDIRECT	y_{28}	SHIFTEVE
y_6	RUINDIR	y_{29}	SHIFTNGH
y_7	RUPERSUA	y_{30}	DCHX
y_8	PSA	y_{31}	SHIFTSAT
y_9	COSMOPOL		
y_{10}	AGE		
y_{11}	SEX		
y_{12}	INCOME		
y_{13}	YRLASTED		
y_{14}	JOBSAT		
y_{15}	MARITALD		
y_{16}	EDUCHIGH		
y_{17}	YRSWORK		
y_{18}	HLSA		
y_{19}	RINSERV		
y_{20}	RCOURSES		
y_{21}	HRWKPRES		
y_{22}	CLIN2		
y_{23}	CLIN3		

Appendix F

Variance/Covariance Matrix for the Validation Model*

	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}
y_1	3.484									
y_2	2.425	3.382								
y_3	2.294	2.271	3.442							
y_4	2.080	2.003	2.629	3.105						
y_5	2.066	2.226	2.300	2.952	3.718					
y_6	1.345	1.401	1.595	1.437	1.467	3.073				
y_7	0.749	0.939	1.470	1.248	0.908	0.994	3.060			
y_8	1.518	1.863	1.401	1.517	1.821	1.042	2.991	29.031		
y_9	0.524	-0.463	0.466	0.905	0.179	0.406	1.786	6.496	35.033	
y_{10}	0.309	0.387	0.333	0.310	0.406	0.275	0.231	1.390	0.292	1.098
y_{11}	1.453	1.315	1.153	0.978	0.811	0.830	0.797	2.776	1.560	0.198
y_{12}	0.089	0.033	0.095	0.083	0.029	0.116	0.132	1.121	1.051	-0.031
y_{13}	1.259	1.606	0.143	0.948	2.309	1.625	3.055	5.688	7.879	0.774
y_{14}	1.825	1.700	2.394	2.074	1.646	1.941	1.107	4.485	4.031	0.340
y_{15}	0.893	0.913	0.738	1.033	1.254	0.288	1.937	14.653	4.351	1.021
y_{16}	-0.043	0.199	0.163	0.599	0.887	-0.037	0.471	1.625	3.456	0.462

(...continued)

(.....continued)

	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}	y_{16}
y_{11}	12.186					
y_{12}	0.028	0.839				
y_{13}	6.440	-0.573	148.538			
y_{14}	0.921	0.678	-2.059	10.119		
y_{15}	2.406	0.615	11.870	1.673	24.174	
y_{16}	-0.154	-0.095	9.381	-0.071	1.405	17.941

*Corresponding variable names for Validation Model covariance matrix

y_1	RUO#1	y_9	COSMOPOL
y_2	RUO#2	y_{10}	JOBSAT
y_3	RUO#3	y_{11}	RINSERV
y_4	RUO#4	y_{12}	RCOURSES
y_5	RUDIRECT	y_{13}	HRWKPRES
y_6	RUINDIR	y_{14}	ATTITUDE
y_7	RUPERSUA	y_{15}	AUTONOMY
y_8	PSA	y_{16}	ACTIVISM

Appendix G

Variance/Covariance Matrix for the Combined Model*

	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}
y_1	3.570									
y_2	2.555	3.381								
y_3	2.240	2.226	3.269							
y_4	2.130	2.072	2.543	3.120						
y_5	2.210	2.399	2.353	2.126	3.674					
y_6	1.496	1.488	1.709	1.539	1.573	3.195				
y_7	0.922	1.074	1.356	1.221	1.039	1.052	3.084			
y_8	2.035	1.929	1.886	1.873	1.723	1.605	2.485	29.144		
y_9	1.862	1.146	0.445	2.021	0.986	1.055	1.190	5.980	37.677	
y_{10}	-.047	-.046	-.029	-.030	-.074	-.015	-.030	-.060	-.008	.097
y_{11}	2.444	2.640	2.931	2.776	2.052	1.553	2.537	5.808	4.999	-.081
y_{12}	-2.361	-2.509	-3.355	-2.708	-2.073	-3.025	-1.810	-7.455	-2.328	.021
y_{13}	0.408	0.450	0.344	0.380	0.430	0.319	0.177	0.629	-0.044	1.174
y_{14}	1.362	1.342	0.960	0.983	0.723	0.580	0.795	1.980	2.311	0.308
y_{15}	0.198	0.131	0.217	0.205	0.111	0.189	0.104	1.071	0.812	-0.015
y_{16}	.253	-.027	.255	.200	.206	.699	1.387	3.648	3.539	.035
y_{17}	.002	.197	.242	.325	.253	.166	.221	-.369	-1.508	-.023
y_{18}	1.165	1.378	0.734	0.278	1.792	2.041	2.001	3.963	2.651	-.178
y_{19}	1.894	1.862	2.225	1.982	1.844	1.845	1.315	3.863	4.357	.015
y_{20}	0.756	0.729	0.629	0.891	0.848	0.466	1.766	11.808	5.267	-.023
y_{21}	1.188	1.182	1.073	1.425	1.320	0.733	1.164	2.573	6.380	-.104

(...continued)

(...continued)

	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}	y_{16}	y_{17}	y_{18}	y_{19}	y_{20}
y_{11}	23.979									
y_{12}	-7.472	70.026								
y_{13}	.211	-.169	1.174							
y_{14}	1.968	-1.889	.308	13.341						
y_{15}	.660	-1.363	-.015	-.073	.958					
y_{16}	.881	-.435	-.179	.925	.322	35.184				
y_{17}	.308	1.221	.125	-.764	-.256	.394	3.534			
y_{18}	-.304	-3.374	1.254	8.049	-.114	-4.626	-4.916	140.582		
y_{19}	6.163	-5.415	.255	.839	.568	-.158	-.047	-.764	9.139	
y_{20}	3.580	-.861	.635	1.513	.276	3.166	-.078	9.740	1.264	23.042
y_{21}	1.470	-2.985	.316	-.272	.247	5.095	.494	4.421	.817	3.463

	y_{21}
y_{21}	21.655

*Corresponding variable names for Validation Model covariance matrix

y_1	RUO#1	y_{12}	DOGMATSM
y_2	RUO#2	y_{13}	JOBSAT
y_3	RUO#3	y_{14}	RINSERV
y_4	RUO#4	y_{15}	RCOURSES
y_5	RUDIRECT	y_{16}	HLSA
y_6	RUINDIR	y_{17}	DCHX
y_7	RUPERSUA	y_{18}	HRWKPRES
y_8	PSA	y_{19}	ATTITUDE
y_9	COSMOPOL	y_{20}	AUTONOMY
y_{10}	AFFILP	y_{21}	ACTIVISM
y_{11}	BELIEFT		